Kodiak Seiners Association
PO Box 8835
Kodiak, AK 99615

December 12, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: **Oppose Proposal 62**

Dear Chairman Morisky and Board of Fish Members:

The Kodiak Seiners Association is writing to express our **opposition to proposal 62**. To be absolutely clear, our contention with this proposal is founded in the underlying insinuation that Kodiak fishermen are dishonest and lawless swindlers. This proposal is at its core a direct insult to our fishermen and its premise is entirely preposterous. There has never been a single reported incident of Kodiak fishermen intentionally mis-reporting harvest at the Cape Igvak area, nor have any of our members ever heard of anyone committing such a scheme. When this proposal was submitted in 2017 Board of Fisheries meeting the Alaska State Troopers issued a public report that they had examined numerous vessels traversing the Shelikof Straight from the Cape Igvak area, and all of the fishermen had already delivered and properly reported their harvest.

The Board should be aware that the assertion of a "strong incentive" to misreport harvest at Cape Igvak is absurd. If fish harvested at in the Cape Igvak area were misreported as being harvested elsewhere, then those fish would not be allocated directly to the individual fishermen but instead to the whole Kodiak fleet. With an average of 53 boats annually participating the Cape Igvak fishery and 90% assignment rate of fish as "Chignik Bound", this means that the offending fishermen could reasonably expect to harvest 90% of 1/53rd of the fish that he/she misreports, which amounts to a mere 1.7% of the illegally reported delivery. To put this figure into perspective, if the vessel harvested 1000 fish, a pretty good delivery, the fishermen could only reasonably expect to gain a harvest of 17 fish by breaking the law, and this is only if there is subsequent opening in the Cape Igvak area.

Additionally, processors typically require vessels to deliver fish before traveling to and from the Cape Igvak area, with some requiring daily deliveries due to quality concerns related to long transport times between Igvak and Kodiak. Fishermen also tend to prefer delivering before leaving the Igvak area in order to avoid the cost of running refrigeration equipment over long travel periods and to prevent having to arrange tender service in other areas which would likely mean a sacrifice of fishing time. It is more cost effective and convenient for fishermen to deliver to a nearby tender in

the Igvak area and, and there is no way for the 17 out of 1000 fish incentive to possibly overcome the burden of delivering the fish elsewhere.

KSA would like to reassure the Board that Kodiak fishermen are honest and hardworking small business owners. We have no interest in conducting illegal scams to earn our living and just wish for a fair opportunity to sustain our fishing rights and continue the orderly prosecution of our fishery.

KSA respectfully requests the Board to **reject proposal 62.** We thank you for the opportunity to comment on behalf of the membership of KSA. We appreciate the scientific and factual creation of regulations regarding our fisheries and trust that the Board continue to apply consistency in designing regulation changes while applying the guiding BOF policies, such as the Management for Mixed Stock Salmon Fisheries.

Kodiak Seiners Association represents 157 members, including the majority of actively fishing SO1K seine permit holders, Kodiak and Homer-based businesses, and individual crewmembers. Our focus is advocacy for our membership through positive interactions with ADF&G, the Board of Fisheries, and our State Legislature.

Sincerely,

Nate Rose
KSA President

December 24, 2019

Matthew Alward

60082 Clarice Way

Homer, AK 99603

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: Opposition to proposal 62

Dear Chairman Morisky and board of fisheries members,

I reside in Homer, AK and make my living participating in the Kodiak salmon seine fishery and I oppose proposal 62 which accuses Kodiak fishermen of breaking the law. I have raised my family on the back deck of our seine boat and have participated many times in the Cape Igvak fishery.

The bases of this proposal is the unfounded accusation that fishermen are taking their harvest of fish caught in the Cape Igvak section back to Kodiak Island to deliver and reporting them on their fish tickets as harvested on the Island which is a crime. This same proposer has made the same accusations the last two board cycles and has never provided any evidence of this activity occurring. In fact the last time that the Igvak section was open in June the Alaska State Troopers boarded fishing vessels leaving the Igvak section and inspected their fish holds and found no evidence of anyone trying to falsify fish tickets.

The claim is that Kodiak fishermen have strong incentive to break the law is not born out by the facts. While it is true that if sockeye harvested in the Igvak section is underreported it is not counted against the 15% allocation that the Igvak management allows, it would have to be a very large occurrence of many boats breaking the law to make any significant financial gains for an individual. On average there have been around 50 vessels that partake in the Igvak fishery. If one boat was to miss report their Igvak harvest whatever amount of fish they lied about would be available to the whole fleet to catch. I don't know why anyone would risk a fishing violation on their record and fines to give 49 other fishermen an opportunity to catch those fish.

This proposal would make it so we have to call into the department before entering and leaving the Igvak section. Igvak opens and closes at midnight which would require Fish and Game staff to be on duty through the night to take calls. It also requires everyone to have a satellite phone to make the call. While I do have a very expensive sat phone on my boat, last season it was broke down for two thirds of the season and if this proposal was in place I would not have been able to make a call to the department.

In closing this is the third time that this proposer has accused Kodiak fishermen of breaking the law with no evidence and I respectively ask that you do not adopt proposal 62.

Sincerely,

Matthew Alward

Nicholas Hoffman
PO Box 1212
Kodiak, AK 99615

12/24/19

Chairman Reed Moriskey
Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: Oppose Proposal 62

Dear Chairman Morisky and Board of Fish members:

I'm a young Kodiak salmon fisherman. I have been running a seine boat since 2011 as well as participating in Kodiak halibut, sea cumber, cod jig, and tanner crab fisheries. I respectfully request the Board reject Proposal 62.

This proposal is insulting to the hardworking fishermen of the Kodiak fleet. Not to mention costly to ADF&G and also possibly a safety concern due to fishermen who may not be able to check out because of technical difficulties being trapped on the mainland if weather comes up. There has never been a ticket given or even a rumor of any Kodiak fisherman driving their fish across the Shelikof for the purpose of misreporting. The number of fish that would need to be misreported would require a large concerted effort by multiple boats to make any difference to our allocation which is unrealistic and implausible. I feel this proposal is a waste of the Board's time because it is based on what is basically a conspiracy theory and in addition was already debated and voted down during the last cycle.

I see no reason for the Board to make any changes to the Kodiak Salmon Management plan. Thank you for the opportunity to comment on the proposals and the chance for my voice to be heard. I look forward to the Board of Fish members getting to spend time in Kodiak and learn more about our town and fishing community.

I humbly request the Board reject Proposal 62.

Sincerely,

Nicholas Hoffman
F/V Relentless

December 24, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 62

Dear Chairman Morisky and Board of Fisheries Members,

I am Richard Roth, Kodiak salmon purse seine permit holder. Thank you for the opportunity to comment on proposals for the Kodiak finfish meeting. My wife three children and I reside in Homer, but fish in Kodiak. I own and operate the F/V Sea Tzar. I formally owned and operated the F/V Kelly Girl. We rely solely on salmon seining for our livelihood and annual income to support our business, our family and contribute to our Alaskan economy through business and personal expenditures.

The author of this proposal argues that Kodiak fishermen are intentionally misreporting fish caught in Cape Igvak area. The Alaska State Troopers previously issued a public report saying that they had examined numerous vessels traveling across Shelikof Strait from the Cape Igvak area, and all of the fishermen had already delivered and properly reported their harvest.

This proposal shows a complete lack of understanding of the geographic realities of fishing the region. In addition to assisting ADF&G in sustainably managing salmon stocks, the Processors in our region would be greatly displeased with the quality of fish that travel across Shelikof Strait and are held for extra time by fishermen. This alone would completely negate the "economic incentive" argument of the author.

This is the second time the Board of Fisheries has had to deliberate on this proposal which would increase the time and financial commitments of ADF&G with absolutely no benefit to any region and would be overly burdensome to Kodiak salmon fishermen.

I request that the Board reject this proposal based which seems to be simply personal assumptions as to the character of their fellow fishermen in another region.

Thank you for your careful consideration,

Respectfully,

Richard, Amanda, Stephanie, Noah, and Ranger Roth
F/V Sea Tzar
Homer, AK

December 19, 2019

Robert Fellows

266 E Bayview Ave.

Homer, AK. 99603

Alaska Board of Fisheries

Board Support Section

PO Box 115526

Juneau, Ak. 99811-5526

RE: Opposition to proposal 62

Dear chairman Morisky and Board of Fisheries members,

I am a commercial fisherman who has fished for salmon in the Kodiak management area for 29 years. I make most of my family's yearly income from this salmon fishery. Historical access to the Cape Igvak section, in years of harvestable surplus in the Chignik management area, is one of the reasons why I started fishing in Kodiak. I respectfully request the Board reject proposal # 62.

This proposer is insinuating that Kodiak fishermen and processors are liars. The implication that fish caught in the Cape Igvak section are delivered somewhere else is completely false. To my knowledge all processors have for decades required their fishermen to deliver within the Cape Igvak section before leaving and many require that their fleet delivers on a daily basis to better track the harvest.

Sincerely,

Robert Fellows

Ron Kavanaugh
self
12/28/2019 12:49 AM AKST

RE: PROPOSAL 62 Require reporting prior to commercial fishing in the Cape Igvak Section and upon leaving the section

After being submitted 3-4 times and failing, I find this proposal to continue to be insulting. It implies that Igvak fisherman are breaking the law. There are no investigations, arrests, or other concerns in regards to this proposals issue. The proposer is insinuating and alleging unlawful behavior with not evidence in fact. The Department of Law finds that it would be hard to enforce. Modeling after Bristol Bay makes no sense. There is no time for stand downs or waiting for conformation. This would lower quality, hinder processor methods of delivering, transporting, and complicate procedure. We would also state that the use of an inreach is not fail proof. You are not guaranteed a timely confirmation. We have waited on replies for days, weeks, and months all while receiving additional messages from other inreach users. Coming and going from Igvak is complicated by weather and timing of both the area and other districts. Delays could reduce efficiency, have high cost from lost opportunity, and create safety concerns.

Steven Roth

12/27/2019 06:32 AM AKST

RE: PROPOSAL 62 Require reporting prior to commercial fishing in the Cape Igvak Section and upon leaving the section

December 24, 2019 Alaska Board of Fisheries Board Support Section P.O. Box 115526 Juneau, AK 99811-5526 Re: Opposition to Proposal 62 Dear Chairman Morisky and Board of Fisheries Members, I am Steve Roth, Kodiak and Lower Cook Inlet salmon purse seine permit holder. Thank you for the opportunity to comment on proposals for the Kodiak finfish meeting. My wife and I reside in Homer, but fish in Kodiak mainly. I own and operate the F/V Sea Grace. We rely solely on salmon seining for our livelihood and annual income to support our business, our family and contribute to our Alaskan economy through business and personal expenditures. The author of this proposal argues that Kodiak fishermen are intentionally misreporting fish caught in Cape Igvak area. The Alaska State Troopers previously issued a public report saying that they had examined numerous vessels traveling across Shelikof Strait from the Cape Igvak area, and all of the fishermen had already delivered and properly reported their harvest. This proposal shows a complete lack of understanding of the geographic realities of fishing the region. In addition to assisting ADF&G in sustainably managing salmon stocks, the Processors in our region would be greatly displeased with the quality of fish that travel across Shelikof Strait and are held for extra time by fishermen. This alone would completely negate the “economic incentive” argument of the author. This is the second time the Board of Fisheries has had to deliberate on this proposal which would increase the time and financial commitments of ADF&G with absolutely no benefit to any region and would be overly burdensome to Kodiak salmon fishermen. I request that the Board reject this proposal based which seems to be simply personal assumptions as to the character of their fellow fishermen in another region. Thank you for your careful consideration, Respectfully, Steve and Jenny Roth F/V Sea Grace Homer, AK

December 24, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 62

Dear Chairman Morisky and Board of Fisheries Members,

I am William Roth, Captian of the F/V Sea Chantey. I own a Kodiak seine permit and have been fishing it for the lasat 5 years as well as working as crew since 2010, I rely mostly on salmon seining for our livelihood and annual income to support our business, our family and contribute to our Alaskan economy through business and personal expenditures.

The author of this proposal argues that Kodiak fishermen are intentionally misreporting fish caught in Cape Igvak area. The Alaska State Troopers previously issued a public report saying that they had examined numerous vessels traveling across Shelikof Strait from the Cape Igvak area, and all of the fishermen had already delivered and properly reported their harvest.

This proposal shows a complete lack of understanding of the geographic realities of fishing the region. In addition to assisting ADF&G in sustainably managing salmon stocks, the Processors in our region would be greatly displeased with the quality of fish that travel across Shelikof Strait and are held for extra time by fishermen. This alone would completely negate the "economic incentive" argument of the author.

This is the second time the Board of Fisheries has had to deliberate on this proposal which would increase the time and financial commitments of ADF&G with absolutely no benefit to any region and would be overly burdensome to Kodiak salmon fishermen.

I request that the Board reject this proposal based which seems to be simply personal assumptions as to the character of their fellow fishermen in another region.

Thank you for your careful consideration,

Respectfully,

William and Kaytlen Roth
F/V Sea Chantey
PO BOX 1230
Homer AK
99603

Aaren Ellsworth

12/28/2019 12:39 AM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

I oppose this proposal. There are very, very few Chinook harvested in the Mainland District. A king salmon genetics study was done in Kodiak waters in 2014 -2016 and the estimated total Cook Inlet king salmon harvest for the Mainland District was 7 fish in 2014, 29 fish in 2015, and 62 fish in 2016. It is absurd to propose massive closures and disruptions to traditional fisheries for infinitesimal savings in Chinook harvest.

Aaron Nevin

12/27/2019 08:54 PM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

There is no evidence or reason to believe that this proposal would achieve its desired affect. My name is Aaron Nevin. Being born in Kodiak to a commercial fisherman father I grew up fishing salmon on his seiner. I have continued on in my currently twenty year long career to buy a permit and run his boat after retirement. The seining season usually accounts for the majority of my annual income and is incredibly important to my family.

Adam Barker
Kashvik Fisheries LLC
12/26/2019 11:38 PM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

Adam Barker 41584 Manson Dr Homer, AK 99603 December 26th 2019 Chairman Reed Morisky Alaska Board of Fisheries-Board Support Section P.O. Box 115526 Juneau, AK 99811-5526 RE: Prop 63 Dear Chairman of the Board of fish members My name is Adam Barker, I am a third generation fisherman who started fishing in Kodiak in 1988 with my dad. I am an owner operator and bought into the Kodiak seine fishery in 1999. My children now help on my boat in the summer. I would like to reject this extreme and biased proposal, I would like to expose it as a ploy to try and enhance the struggling Cook Inlet salmon gillnet fishery. What is changing in their fishery is the user groups and the destruction of the local salmon nesting areas. The growth of human population on the Kenai Peninsula and the popularity of sport fishing and charter fishing in these areas. Preventing seining the capes on Kodiak Island will not rejuvenate Cook Inlet salmon. Please reject this proposal as a request to try and fix a problem that is caused by many factors and cannot be pinned on Kodiak seiners fishing as they have for the last 40 years. I hope the board continues to apply consistency in its application of the guiding policies such as the mixed stock fisheries policy, and the sustainable fisheries policy. Sincerely, Adam Barker

Adelia Myrick

12/26/2019 09:45 AM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

Dear Board of Fish Members, I am a second-generation Kodiak fisherman. My father started salmon fishing here in 1967, and I have setnetted since I was a toddler with my family, for my whole life. I took over the permit from my dad several years ago, and in 2016 finally bought the setnet operation from my parents outright. Though I am not a seiner, this creation of restricted commercial seine fishing would impact my business because it would crowd the other areas, notably the central district of the Northwest Kodiak district. I have concerns with the math on this proposal and the seemingly arbitrary number of hours of fishing allowed per week. Also, the author of the proposal seems to discount the release of chinook by the seine fleet but it appears that his mortality rate numbers are not based on this fishery and are therefore completely suspect. Obviously people are concerned about fishing in these areas and are proposing any and all ideas they can think of to restrict the seine fleet but it is apparent that they are not based on hard data. Thank you for your consideration, Adelia Myrick

December 24, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 63

Dear Chairman Morisky and Board of Fisheries Members,

I am Alex Roth, Kodiak and Lower Cook Inlet salmon purse seine permit holder. Thank you for the opportunity to comment on proposals for the Kodiak finfish meeting. My wife and I reside in Homer, but fish in Kodiak. I own and operate the F/V Wandering Star. We rely solely on salmon seining for our livelihood and annual income to support our business, our family and contribute to our Alaskan economy through business and personal expenditures.

According to the 2014-2016 study of Genetic Stock Identification of Chinook Salmon in the sport and commercial fisheries in Kodiak, 80% of the kings caught in both sport and commercial fishery are from British Colombia and U.S. West coast. In 2014 the total Kodiak Management Area commercial harvest of Cook Inlet origin kings was **182 fish**, in 2015 total Cook Inlet origin kings was **334 fish**, and in 2016 total Cook inlet origin kings was **260 fish**. The economic loss of amending the Kodiak Management Plan per the proposer's recommendations could never be balanced by the economic gain to the Cook Inlet region of another approximately 180-334 individual kings total.

In 2016 McDowell prepared a report on the economic impact of the seafood industry in the Kodiak region for the Kodiak Island Borough (KIB) and the City of Kodiak. They found that for every million pounds of salmon landed and processed in the KIB, $900,000 in total labor income is created in the KIB economy, including all direct, indirect, and induced effects. For every million dollars paid to fishermen for salmon landed in the KIB, a total of $1.22 million in labor income is created in the KIB. This doesn't even include fishermen, like me, where our income contributes directly to the economy of the Kenai Peninsula.

This proposal is short-sighted and borders on absurd in its aim to claim a small handful of kings at the expense of a much larger fishery which contributes to the food security of our nation.

I request that the Board to reject this proposal.

Alex and Jaime Roth
F/V Wandering Star
Homer, Alaska

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

Bo Calhoun 57177 Zulu Ct. Homer, AK 99603 12/26/19 RE: Opposition to Proposal #63 Dear Chairman Morisky and Board of Fish members: I'm a third generation Kodiak salmon seiner. I was born in Homer, raised in Port Lions and Homer, and continue to live in Homer. My wife and I hope to raise our two sons on our family seine boat in a healthy Kodiak salmon fishery. I respectfully request you reject Proposal #63. There is no evidence this proposal would protect more Chinook, since it's not clear seaward zones have disproportionately high catches of Chinook. Also, the numbers of Chinook caught in this area are so small, they don't justify the potential losses to the Kodiak fishery. Please oppose proposal #63. Thank you for taking the time to read public comments. Sincerely, Bo Calhoun

Brad Marden
PO Box 2856
Homer, AK 99603

December 23, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: **opposition to Proposal 63**

Dear Chairman Morisky and Board of Fish members:

I first participated in the Kodiak seine fishery for salmon in 2004. Since then, I've worked as a deckhand in various salmon, halibut, and herring fisheries throughout the state (including work on Upper Cook Inlet drift boats), before buying my own boat in 2012, followed by a Kodiak seine permit in 2013. Since then I have exclusively fished in Kodiak waters. I respectfully request the Board **reject Proposal 63**.

Proposals to create additional "seaward" and shoreward" zones for Kodiak seiners fishing the Mainland district allocation will do little or nothing to help conserve Upper Cook Inlet-bound Chinook salmon. Catching a single king in this region is notable, and the fish is required to be returned unharmed to the water, and there is no financial incentive whatsoever for fishermen to target this species. This proposal was poorly researched and is based more on conjecture and extrapolation than any facts. Instead of helping conserve UCI-bound Chinook, the proposal would prove harmful to the entire Kodiak salmon fleet, and with no benefit. We must all work to help conserve Chinook stocks around the state, but this proposal would be ineffective, with costly unintended consequences. Fishing opportunity in the Mainland District fishery helps spread out our Kodiak fleet and can be an important part of having a decent fishing season for Kodiak fishermen. Fisheries managers are already empowered with a variety of tools to manage the Mainland District.

I am sure that the Board tires of endless testimony claiming that the fish of concern are "our fish being stolen by those guys over there". It seems that in my 15 years of commercial fishing in Alaskan waters, Kodiak salmon fishermen are often the scapegoat. Rather than passing the blame along to the next guy, I ask that we consider proposals with more merit and less collateral damage. For this reason, I ask that you **reject Proposal 63**. I want to thank you for your service and I hope the Board continues to apply consistency in upholding Mixed Stock Fisheries Policy, and the Sustainable Fisheries Policy.

Sincerely,

Brad Marden

Brian Mcwethy
KSA
12/23/2019 09:23 AM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

My name is Brian Mcwethy. I was born and raised in kodiak. I live in kodiak with my family and we all depend on my income. I fished with my father on his seiner growing up and now I own and operate a seiner. Salmon seining and tanner crab fishing in kodiak are currently our only sources of income. I plan to try and continue to fish the kodiak waters and possible my children will have the opportunity to. I hope the current and historical areas we fish aren’t taken from us and the future generations of kodiak. I oppose this proposal strongly. This proposal would greatly decrease the area we could fish. In an already crowded fishery the loss of any fishing area would greatly affect all area K users. Seiners and setnetters would have more completion and less opportunity.

December 22, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 63

Dear Chairman Morisky and Board of Fisheries Members,

My name is Chris Johnson and I am a second-generation fisherman in Kodiak, Alaska. I grew up fishing on my dad's boat and got my first crew job working for someone else two weeks after I graduated high school. I haven't missed a salmon season since. I bought into the fishing industry in 2011 with the purchase of a 25-foot jig boat that I worked for two years in the winter and spring months while I still crewed for salmon in the summer. Access to the jig fisheries focusing on cod and rockfish was the only way that I could afford to move into the salmon fleet with a 38-footer in 2013. After the recent cod collapse, I now primarily rely on salmon seining and live here year-round with my wife.

According to Genetic Stock Identification of Chinook Salmon in the sport and commercial fisheries in Kodiak from 2014-2016, 80% of the kings caught in both sport and commercial fishery are from British Colombia and U.S. West coast. In 2014 the total Kodiak Management Area commercial harvest of Cook Inlet origin kings was 182 fish, in 2015 total Cook Inlet origin kings was 334, and in 2016 total Cook inlet origin kings was 260.The economic loss of amending the Kodiak Management Plan per the proposer's recommendations could never be balanced by the economic gain to the Cook Inlet region of another approximately 180-334 kings.

Taking away any fishing opportunity from Kodiak fishermen, particularly from the small boat fleet, would have a direct negative impact on new entrants trying to gain a foothold in this industry, fishing families trying to get by, and fishing support businesses in our region. I'm proud to call Kodiak home and am working to protect our fishing way of life.

Sincerely,
Chris Johnson
F/V North Star

December 22, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 63

Dear Chairman Morisky and Board of Fisheries Members,

My name is Danielle Ringer and I appreciate the opportunity to comment on proposals before the Board in writing and in person for the Kodiak finfish meeting. I live in Kodiak with my husband and we own and operate the 38-foot F/V North Star. We chiefly rely on salmon seining and cod and rockfish jigging to maintain our fishing way of life and ability to live on Kodiak Island. I grew up in Homer learning to harvest and process fish from my parents in Kachemak Bay and dipnetting on the Kenai River. I hold a Master's degree from the University of Alaska Fairbanks in Political Ecology of Fisheries and was one of the researchers on the *Graying of the Fleet in Alaska's Fisheries: Defining the Problem and Assessing Alternatives* study in the Kodiak region.

According to Genetic Stock Identification of Chinook Salmon in the sport and commercial fisheries in Kodiak from 2014-2016, 80% of the kings caught in both sport and commercial fishery are from British Colombia and U.S. West coast. In 2014 the total Kodiak Management Area commercial harvest of Cook Inlet origin kings was 182 fish, in 2015 total Cook Inlet origin kings was 334, and in 2016 total Cook inlet origin kings was 260.The economic loss of amending the Kodiak Management Plan per the proposer's recommendations could never be balanced by the economic gain to the Cook Inlet region of another approximately 180-334 kings.

In 2016 McDowell prepared a report on the economic impact of the seafood industry in the Kodiak region for the Kodiak Island Borough (KIB) and the City of Kodiak. They stated that by quantifying the relationship between harvest volumes and values and labor income in 2014, the analysis could provide guidance on the potential economic impact of changes in seafood industry activity in the region. For example:

- For every million pounds of salmon landed and processed in the KIB, $900,000 in total labor income is created in the KIB economy, including all direct, indirect, and induced effects.
- For every million dollars paid to fishermen for salmon landed in the KIB, a total of $1.22 million in labor income is created in the KIB, including all harvest and processing related multiplier effects.

I see no biological, scientific, historical, economic, nor sociocultural reasons that could justify the Board making any changes to the salmon management plans in the Kodiak Management Area, which would create ripple effects negatively impacting Kodiak fishermen, processing workers, and community businesses. Thank you for your consideration of my comments and I

look forward Board of Fisheries members spending time in our fishing community during the Kodiak meeting.

I humbly request the Board to reject this proposal.

Respectfully,
Danielle Ringer, M.A.
F/V North Star

Dave Kubiak
F/V Lara Lee
12/21/2019 02:00 PM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

This passionate and radical proposal is not supported by science. 80% of Kings caught in the sport and commercial fishery are from British Columbia and US West Coast. The results of this proposal would be a huge economic loss offset by a very few more Kings returning to Cook Inlet. Reversing the degradation of natal spawning habitat closer to home may yield more productive solutions.

Donald Lawhead

12/26/2019 10:57 PM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

There is no need to change the mangement plan. There is no data to support this proposal.

Fred Stager

F/V Lady Lu

December 12, 2019

Alaska Board of Fisheries Board Support Section

P.O. Box 115526 Juneau, AK 99811-5526

RE: Opposition to Proposal 63

Dear Chairman Morisky and Board of Fish Members,

I am writing to ask you to **oppose proposal 63.** Creating "seaward" and "shoreward" harvest zones in the mainland district of the Kodiak Management Area (KMA) with the intention of preserving king salmon bound for Cook Inlet waters. While I understand that King Salmon populations in the Western Gulf of Alaska are at unprecedented lows and that these circumstances call for extreme management measures in order to preserve stocks with critically low populations. I endorse and encourage the continuation of the non-retention policy for king salmon in Kodiak waters. This policy has now been in place for 6 seasons and amounts to an extraordinary and unusual conservation practice that our fleet has willingly accepted.

Proposal 63 relies on fundamentally flawed assumptions about the harvest of king salmon in Kodiak. There is no evidence to suggest that king salmon are harvested in greater abundance in the Seaward Zones, and in fact, feeding kings typically accumulate further into bays where they prey on herring, capelin, and other schools of baitfish. These salmon, colloquially termed "feeders" have particularly high mortality rates when released due to scale loss. Feeders comprise the majority of king salmon harvested in Kodiak, and adoption of proposal 63 would likely intensify the harvest and mortality of king salmon in the KMA. Forcing the seine fleet into

"shoreward zones" is therefore a counterproductive approach to conserving king populations and it entirely lacks a sound scientific basis.

There is absolutely no factual basis to believe that the areas covered by this proposal exhibit consistently high harvest rates of Cook Inlet chinook stocks, and given that the catch of chinook is typically random and evenly diffused throughout harvest in the KMA, the Board can expect that every chinook preserved by this plan will result in the unintended harvest loss of at least tens of thousands of salmon of various species from healthy stocks. Unless there are absolutely no other management measures that can be taken in the vicinity of the runs of concern, it would be entirely unjustifiable to enact a management plan that has such immense and certain costs without conveying any measurable benefits.

Board policy must be applied consistently throughout the state. If the current Board wishes to engage in such a drastic policy shift that it would begin adopting additional measures to further limit the harvest of non-local stocks in Kodiak then we would expect and anticipate these standards to apply to regions to our south, such as the Chignik Management area, where there are currently *no* measures in place designed to limit the harvest of non-local stocks. The Kodiak seine fleet has had to bear the sole burden of conservation for our local stocks in addition to the conservation burden of non-local harvest inherent in the Cape Igvak and North Shelikof Straight management plans. Salmon management in the Western Gulf of Alaska already exhibits an inequitable distribution of the burden of conservation due to the uneven applications of Board policies. Kodiak fishermen have been resultantly held accountable for non-local harvest while our own stocks are apparently considered unworthy of similar concerns when harvested in other management areas.

Without knowledge of what is causing the scarcity of king salmon, but with an understanding that minimal volume of Cook Inlet origin king salmon is caught in the KMA, it is important that the public temper its expectations of conservation potential within the Kodiak area. You cannot use management measures in the KMA to conserve fish that Kodiak fishermen simply aren't catching. **Please reject proposal 63.** Thank You- Fred Stager

garrett kavanaugh

12/27/2019 05:19 PM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

Dear Chairman and Members of the Board, As a young fishermen who is working their way into the Kodiak Salmon fishery this proposal will cause Kodiak fishermen to lose a substantial amount of their catch. I have been investing into the Kodiak salmon fishery as much as possible, in 2019 I purchased a Kodiak salmon permit. I ran a seiner for the month of august. I plan on running the same boat for the entire 2020 salmon season in Kodiak. When I was younger I remember testifying against proposals similar to these. These proposals are re-allocations of Kodiak historical catch. Kodiak has always had intercept fisheries and we already have management plans in place that have been effective for the Kodiak salmon fishery. Please help ensure the future for young fishermen entering into the Kodiak Salmon fishery, and the people who have been investing and are established in the fishery. Thank you for considering these comments, Garrett Kavanaugh

Iver Holm

12/28/2019 12:27 AM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

Dear Chairman Morisky and Board of Fish members: I am 31 years old and a life long resident of Kodiak. I grew up set netting in Uganik on the west side of the island with my mother until i was 14. I then started seining with my father until I was able to buy my own Kodiak seine operational the age of 27. Please oppose proposal 63. thank you for your time sincerely
Iver Holm

James Calhoun

12/26/2019 02:59 PM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

I have been intimately involved in the Kodiak seine fishery since 1968 to present. Presently my son is fishing the Kodiak area and it is my desire to have my grandsons be able to participate in a healthy Kodiak fishery if they so desire. Throughout my career I have come to the conclusion that the ADF&G management for Kodiak has been stellar and has kept the stocks in Kodiak healthy overall with the current management plan. It has been my experience my commercial and sport catch of kings have in been bays not offshore. Forcing boats inshore would only exacerbate catch and be contrary to the intent of this proposal. The king salmon catch in this area is relatively small and Cook Inlet bound kings smaller yet. It would seem to me to be more effective to eradicate the pike populations in the rivers in Northern Cook Inlet. I oppose proposal 63. thank you.

Jamin Hall

12/27/2019 11:15 PM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

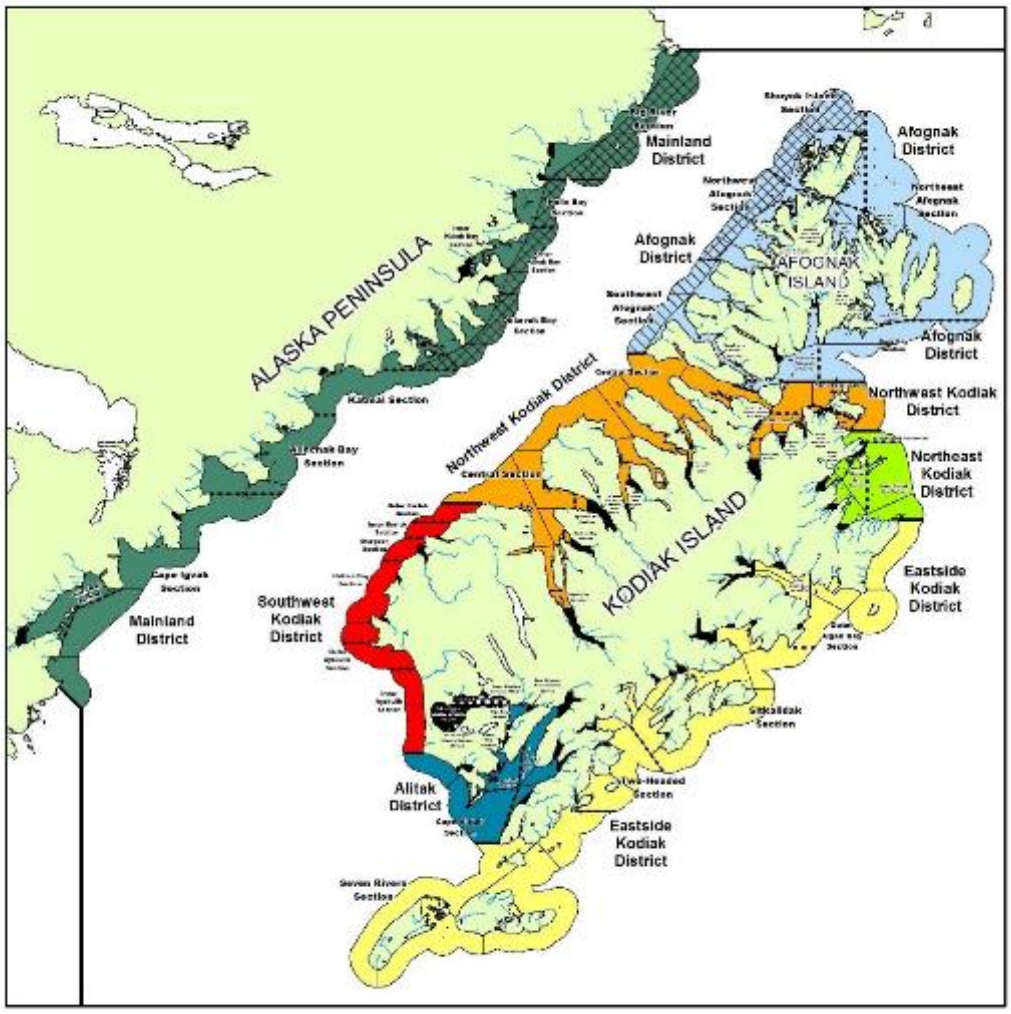
My name is Jamin Hall, my wife and I have a set net site in Uganik Bay. I am writing in opposition to proposal 63.

Ken Christiansen
F/V Mary Ann
12/26/2019 03:28 PM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

The economic loss of amending the Kodiak Management Plan per the proposers recommendations could never be balanced by the economic gain to the Cook Inlet region of another 180-334 kings. Any change to a management plan should be based on scientific reason. Outcry from one user group to take from another is simply a knee-jerk reaction with a sense of immediate gratification but not necessarily improved results.

December 2019



Synthesis of Chinook Salmon Stock Contribution Estimates within the Kodiak Management Area **Commercial Salmon Fisheries (Proposals 63 & 37)**

Kodiak Salmon Work Group

EXECUTIVE SUMMARY

- During all years and sampling periods regardless of the commercial salmon fishery district sampled, British Columbia (hatchery stocks) Chinook salmon dominated the stock

composition of the harvest. Estimates of contribution ranged from a low of 30% to a high of 70% with respective harvests of several hundred to several thousand fish.

- Consistently, contributions from Washington and Oregon Chinook stocks (Western US stocks) to the KMA commercial harvest ranged from 7.3% to 37% and averaged 28%.

- Contributions from Southeast Alaska/North Gulf Coast were in most cases higher than the combined contributions from both Kodiak and Cook Inlet. The estimates generally seemed to be reflective of periods of higher (1997-1999) and lower abundance (2014-2016) for Southeast Alaska stocks.

- The capability of any marine salmon fisheries sampling program to consistently estimate the harvest, in a timely manner, of at most several hundred fish over a commercial fishing season within the geographic scope of the Kodiak Management Area is untenable. Given the current status of both the Kodiak and Cook Inlet Chinook salmon stocks at present, the actions suggested by Proposal 37 are unwarranted.

- It should be noted that for the Cook Inlet stocks harvested within the Kodiak Management Area, a majority are hatchery fish produced for marine or in-river sport fisheries.

- The Chinook salmon stocks contributing to the Kodiak Management Area commercial fishery are similar to those contributing to most of the marine commercial and recreational fisheries from Yakutat to Adak, or coastwide.

INTRODUCTION

The Kodiak Management Area and the associated salmon fisheries has a long and storied history of sustainable fisheries management success. A foundational feature for this success is the escapement enumeration program using weirs and counting individual fish as they migrate upstream. This program has largely been in place since the early 1900s with weirs operated annually on the Karluk, Ayakulik and Frazer lake systems. Daily and cumulative escapement counts are relayed to the area management office for each system and when combined with other sources of data: harvests, aerial survey index counts (for systems without weirs), fishing effort along with additional biological data (timing, migration patterns, age composition) are all sourced into fishery management decisions and emergency orders to open or close districts, sections and subsections of fishing areas throughout the salmon fishing season. An additional vital feature of this program is the inclusion of enclosures or "traps" that allow for live sampling of the escapement, specifically for sockeye and Chinook salmon and the collection of biological attribute data (age, sex, length) which is imperative for building brood tables which in turn are employed for establishing and evaluating biological escapement goals and generating pre-season forecasts.

An additional prominent feature of the Kodiak Management Area salmon fisheries are the 7 management plans which guide management of the salmon stocks and species during the salmon fishing season which commences in early to mid-June and extends into late September. The management planning process was largely initiated in the mid to late 1970s which was a period of extremely poor salmon production throughout the entire Kodiak Archipelago and was cause for

multiple years of limited commercial fishing by all gear groups with the overall objective of rebuilding wild salmon stocks. These management plans were the result of extensive efforts by ADF&G management and research biologists, commercial fishermen, the local fish and game advisory committee and ultimately the Alaska Board of Fisheries over multiple triannual meetings (Malloy, 1988).

Description of Kodiak Chinook Salmon Fishery

The Kodiak Island area has two wild chinook salmon stocks (Karluk and Ayakulik Rivers) and one introduced run which originates in the Dog Salmon River. There have also been several hatchery produced chinook release sites permitted that promote road accessible shore/boat recreational fisheries. The commercial seine and set gillnet fisheries harvest Chinook salmon incidentally while targeting local sockeye, chum and pink salmon stocks along nearshore migration pathways. The harvests typically occur during June and July and at times the harvests can consist of immature or feeder Chinook that are traversing well established commercial fishing areas in the Westside, Southwest and Alitak Districts. The record commercial harvest of 42,000 fish in 1993 consisted of large numbers of immature/feeder kings and stimulated concern from the recreational sector within the Cook Inlet area that large numbers of the harvested fish were of Cook Inlet origin. The harvest during 1993 was almost twice the previous high estimate of 24,000 fish, which occurred in 1992. As a back drop to this concern, several chinook salmon stocks within Cook Inlet were experiencing poor production (Deshka and Early Run Kenai R.) while simultaneously there was a serge in production from stocks originating in British Columbia, Washington and Oregon which were largely of hatchery origin; a portion of these hatchery fish were marked with a coded wire tag and missing the adipose fin (Swanton, 1997). There are several hatchery stocks in Cook Inlet that were marked and could thereby serve for detecting the presence of these stocks in the Kodiak Fishery. A pilot commercial catch sampling program was initiated in 1994 (Swanton 1997) and was followed by a focused interdivisional sampling and harvest estimation program for the years 1997-1999 (Clark and Nelson 2001). A more contemporary and comprehensive genetic stock identification (GSI) program was conducted for the years 2014-2016 and generally corroborated previous results (Shedd et al. 2016).

North American Chinook salmon Ocean Migrations

There are literally hundreds of Chinook Salmon stocks spanning the Coastline from Oregon, Washington, British Columbia and throughout Alaska from Southeast and along the Alaska Peninsula; these stocks are often referenced as far north migrating stocks, as opposed to stocks that have more localized or truncated ocean migrations. With the advent of Coded Wire Tagging (early 1970s) coupled with extensive High Seas Tagging (conducted throughout the North Pacific) and scale pattern analyses efforts conducted by the University of Washington much insight was gleaned regarding migration patterns along coastal and open ocean migration routes. Substantial increases in hatchery production of Chinook salmon in Oregon, Washington and British Columbia occurred in the early 1990s which resulted in a surge in coastwide abundance. Much of the increased hatchery production was in response to poor production from wild stocks, compensation for habitat destruction, tribal agreements, hydroelectric dam impacts or mitigation owing to wild stock endangered species act (ESA) listings.

Coastwide abundance of feeding/rearing Chinook increased markedly and harvests of Chinook increased both within Alaska's commercial and recreational coastal marine fisheries as well as bycatch of chinook in federal fisheries operating in the Gulf of Alaska. The Pacific Salmon Treaty between the United States and Canada governs harvests of these stocks throughout Southeast Alaska (Ketchikan to Yakutat) where jurisdiction between the parties ends. The harvest of these

stocks throughout the remainder of the Gulf of Alaska is viewed with recognition that they originate in other states or British Columbia and harvest should be limited or constrained where appropriate. This has been the policy direction followed by both ADF&G and the Alaska Board of Fisheries certainly within the last 10-15 years and pertains to Kodiak, Kachemak Bay and Homer spring and winter recreational fisheries and both commercial and recreational fisheries prosecuted in Prince William Sound.

Data Summaries by Year

(Swanton, 1997) Caution is suggested relative to these estimates owing to low marking fractions and less than optimum temporal and spatial sampling coverage**.**

1994

The two Kodiak commercial fishing areas where CWT sampling occurred (Westside and Alitak Districts) experienced a commercial harvest of 5,089 Chinook salmon (80% CI 2,927-7,253 fish) from marked cohorts which represented 32.5% of the sampled harvest. The stock groupings represented by the tag recoveries were: 9.7% Southeast Alaska; 83% from British Columbia; 4.9% from Washington state and 2.4% from Oregon.

From the Westside Kodiak area most of the marked cohorts were of British Columbia origin with marked fish from Southeast Alaska, Washington and Oregon also detected in lower numbers. There was an apparent temporal change in stock contribution from the week of June 12-18 which were more varied, as compared to the period June 19-25 when only British Columbia and Southeast Alaska stocks were detected. The marked cohort contribution estimates for this area spanning 12 June through 30 July was 4,655 fish (80% CI 2,517-6,793 fish) from a total catch of 14,619 fish or 31.8%.

Within the Alitak Bay District all marked fish recoveries were of British Columbia origin and represented 435 Chinook out of a total catch of 640 fish. This represented 68% of the catch during the period off sampling.

(Clark and Nelson 2001)

1997

During the 1997 Kodiak commercial salmon fishing season there were 18,728 Chinook salmon harvested with 89% of the harvest occurring during the CWT sampling period of 9 June-8 August; a majority 67% of this harvest (about 11,000 fish) took place within the Westside area.

The study plan designated a sampling fraction of inspecting 20% of the observed catch for CWT's which is consistent with Coastwide sampling programs sanctioned by the Pacific Salmon Commission.

The number of Chinook salmon inspected for a missing adipose fin in1997 was 6,015 or 36% of the harvest during the sampling period; 37% of the harvest was inspected within the Westside District catch; 60% within the Alitak Bay District; sampling within the Eastside District exceeded 20% and an additional 24% (792 fish) were inspected from harvests within the Mainland fishing District.

The general stock composition from the sampled harvest was: 13% from Alaska stocks, 72% from British Columbia, 7% from Washington and 8% from Oregon Chinook stocks. The 18 tag recoveries from Alaska stocks was further broken down to include 11 recoveries from Cook Inlet: two Kenai River, three Ship Creek, three Ninilchik River, one from Deception Cr., one from Crooked R. and one from Homer Spit.

1998

In 1998 there were 17,341 Chinook harvested commercially during the sampling period 9 June- 8 August with approximately 93% occurring within the Westside (including the Southwest Afognak Section and Northwest Kodiak District), Alitak Bay and Eastside Kodiak Districts. There was 53% of this harvest sampled: 45% in the Westside District, 50% in the Alitak District and 43% within the Eastside District. No samples were collected from the Mainland District as the overall catch was 393 fish.

The identified tagged fish were represented as follows: 31% (79) were Alaska stocks; 49% (125) were from British Columbia; 15% from Washington and 5% from Oregon. The Alaskan stocks originating in Cook Inlet (46 tag recoveries) were three from Resurrection Bay; 5 from Seldovia Harbor; 10 from Homer Spit; 5 from Halibut Cove; 6 from Ninilchik R., 13 from Deception Cr., one from Crooked Cr. and two from the Kenai R. The additional Alaskan stock recoveries were 9 from Southeast Alaska and 24 from the Buskin River.

1999

During the 1999 commercial salmon fishery there were 18,299 Chinook harvested which represented 94% of the harvest that occurred during the June 9-August 8 sampling time frame. About three quarters (73%) of the harvest was realized within the aforementioned fishing areas, and similar to previous years, a majority of the harvest was realized within the Westside Kodiak District. There was 46% of the harvest (7,940 fish) inspected for CWT via a missing adipose fin. Similar to the previous years 45% of the catch was from the Westside District, 41% of the Alitak Bay District. No sampling results were reported for the Eastside District, however 12% of the Mainland District (356 fish) harvest was opportunistically sampled.

There were 201 tag recoveries from the 1999 sampling effort, 124 were from the Westside Kodiak District, 10 from the Mainland District, 20 from the Eastside and three from the Alitak Bay District. There were 32% (64 tagged fish recovered) from Alaska stocks, 31% from British Columbia, 13% from Washington and 24% that originated from Oregon. There were 21 tagged fish recovered that originated from Cook Inlet stocks with distribution by area similar to 1998.

The authors after consulting with fishery management staff, suggested that if any non-local stock or stock grouping was estimated to have a 10-15% exploitation rate (harvest rate applied over the entire brood year) imposed by fisheries within the Kodiak Management Area that this would be cause for concern. In addressing this, Clark and Nelson (2001) stated " Therefore, publication of imprecise, but consistently small harvests of Cook Inlet hatchery cohorts in the KMA fishery provided the best indication of the lack of importance of the KMA fishery in influencing production of chinook salmon bound for Cook Inlet."

(Shedd et al. 2016)

This study employed genetic stock identification techniques to generate stock contribution estimates for chinook salmon harvested within both the commercial and recreational fisheries throughout the Westward Region (Kodiak, Chignik and the Alaska Peninsula Management areas). The information summarized below is only for the commercial fishery within the Kodiak Management Area to maintain consistency in comparing other information presented within this summary. This study focused on 4 Districts/reporting areas and two temporal strata (Early: 1 June-5 July; Late: 6 July-5 August).

2014

Overall, there were 8,382 fish commercially harvested of which 3,050 fish were sampled (sampling fraction of 36.4%) for all areas and time strata. The results of GSI for the entire time and area strata were: 55.6% British Columbia, 34% West Coast US (Washington and Oregon stocks combined),

3.4% Southeast Alaska and Northeast Gulf of Alaska stocks(Southeast Alaska/Gulf Coast, 2.6% Cook Inlet, 1.9% Kodiak and 1.6% referred to as the Eastern Bering Sea stock grouping. The following are the aggregate stock composition estimates broken down by geographical and temporal strata:

Northwest Kodiak District and Afognak(Statistical Areas: 251, 253 and 254)

- Early (1 June-July 5) 72.1% British Columbia stocks, 15.7% West Coast US, 4.3% Kodiak, 2.7% Cook Inlet and 2.4% Southeast Alaska/North Gulf Coast Alaska.
- Late (July 6-August 5) 56.0% British Columbia stocks, 34.7% West Coast US, 4.6% Southeast Alaska/Gulf Coast, 2.2% Cook Inlet and 1.2% Kodiak Stocks.

Eastside Kodiak and Afognak District (Statistical Areas: 258, 259 and 252)

- Early (1 June-July 5): 51.2% British Columbia Chinook stocks, 35.3% West Coast US, 4.2% Southeast Alaska/Gulf Coast, 0.3% Cook Inlet and 4.2% Kodiak stocks.
- Late (July 6- August 5):51.7% British Columbia stocks, 37.5% West Coast US, 2.6% Southeast Alaska/Gulf Coast, 4.0% Cook Inlet and 0.1% Kodiak Chinook salmon stocks.

Southwest Kodiak Alitak Districts (Statistical Areas: 255, 256 and 257)

- Early (June 1-July 5): 51.2% British Columbia stocks, 30.8% West Coast US, 6.1% Southeast Alaska and Gulf Coast, 1.1 % Cook Inlet and 10.0% Kodiak Stocks.
- Late (July 6-August 5): 54.5% British Columbia, 39.0% West Coast US, 2.9% Southeast Alaska/Gulf Coast, 1.4% Cook Inlet and 1.0% Kodiak stocks.

Mainland District (Statistical Area 262) There was no sampling conducted for the "Early" strata during 2014.

- Late: July 6-August 5): 51.2% British Columbia Stocks, 39.5% West Coast US stocks, 4.8% Southeast Alaska/Gulf Coast, 1.5% Cook Inlet and 0.9% Kodiak stocks.

2015

During 2015 the Chinook harvest was 8,087 of which 2,775 fish were sampled resulting in a 34% sampling fraction. The estimated stock contributions for this commercial fishing season were: 51.6% British Columbia, 33.9% West Coast US, 4.9% Southeast Alaska/Gulf Coast, 4.5% Cook Inlet and 4.5% Kodiak.

Northwest Kodiak District and Afognak(Statistical Areas: 251, 253 and 254)

- Early (June 1-July 5): 54.8% British Columbia, 24.3% West Coast US, 8.5% Southeast Alaska/Gulf Coast, 6.4% Cook Inlet and 4.5% Kodiak.
- Late (July 6-August 5):52.1% British Columbia, 34.9% West Coast US, 4.9% Southeast Alaska and Gulf Coast, 4.3% Cook Inlet and 3.2% Kodiak.

Eastside Kodiak and Afognak District (Statistical Areas: 258, 259 and 252)

- Early (June 1-July 5):36.4% British Columbia stocks, 46.8 West Coast US stocks, 4.8% Southeast Alaska and Gulf Coast stocks, 7.8% Cook Inlet and 3.1% Kodiak Chinook Stocks.
- Late (July 6-August 5):49.4% British Columbia stocks, 40.7 West Coast US stocks, 3.5% Southeast Alaska and Gulf Coast, 1.3% Cook Inlet and 4.3% Kodiak Chinook stocks.

Southwest Kodiak and Alitak Districts (Statistical Areas: 255, 256 and 257)

- Early (June 1- July 5): 33.8% British Columbia stocks, 35.2% West Coast US, 3.2% Southeast Alaska/Gulf Coast stocks, 2.5% Cook Inlet and 24.9% Kodiak Stocks.

- Late (July 6-August 5):63.1% British Columbia stocks, 30.3% West Coast US, 3.4% Southeast Alaska and Gulf Coast stocks, 1.4% Cook Inlet and 1.2% Kodiak Chinook stock contributions.

Mainland District (Statistical Area 262) Similar to 2014, there was no sampling conducted during 2015 within the period June 1- July 5 for this district.

- Late (July 6-August 5): 64% British Columbia stocks, 19.6% West Coast US, 3.0% Southeast Alaska/Gulf Coast, 12.8% Cook Inlet stocks and no contribution from Kodiak Chinook stocks.

2016

The harvest during 2016 was only 7,471 Chinook of which 3,189 fish were sampled, which represented a 43% sampling fraction. The various stock contributions to the commercial harvest for 2016 were: 56.5% British Columbia, 30.6% West Coast US, 6.2% Southeast Alaska/Gulf Coast, 3.8% Cook Inlet and 1.3% Kodiak stocks.

Northwest Kodiak District and Afognak (Statistical Areas: 251, 253 and 254)

- Early (June 1-July 5): 59.6% British Columbia stocks, 15.0% West Coast US, 12.7% Southeast Alaska and Gulf Coast, 7.8% Cook Inlet and 3.2% Kodiak stocks.
- Late (July 6-August 5):61.8% British Columbia stocks, 17.3% West Coast US, 11.5% Southeast Alaska and Gulf Coast, 6.7% Cook Inlet stocks and 1.6% Kodiak stocks.

Eastside Kodiak and Afognak District (Statistical Areas: 258, 259 and 252)

- Early (June 1- July 5): 57% British Columbia stocks, 27.4% West Coast US Chinook stocks, 6.4% Southeast Alaska/Gulf Coast, 2.3% Cook Inlet and 2.6% Kodiak stocks.
- Late (July 6-August 5):51.5% British Columbia Chinook stocks, 39.5% West Coast US stocks, 1.3% Southeast Alaska/Gulf Coast stocks, 3.8% Cook Inlet and 2.8% Kodiak stocks.

Southwest Kodiak and Alitak Districts (Statistical Areas: 255, 256 and 257)

- Early (June 1-July 5): 67.1% British Columbia, 24.6% West Coast US stocks, 3.1% Southeast Alaska/Gulf Coast, 1.4% Cook Inlet and 2.9% Kodiak stocks.
- Late (July 6-August 5): 69.2% British Columbia stocks, 24.7% West Coast US, 1.8% Southeast Alaska, 2.5% Cook Inlet stocks and 1.1% Kodiak Chinook stocks.

Mainland District (Statistical Area 262)

- Early (June 1-July 5): 46.6% British Columbia stocks, 44.1% West Coast US, 3.6% Southeast Alaska and Gulf Coast, 1.9% Cook Inlet and 0.3% Kodiak stocks.
- Late (July 6-August 5):54.1% British Columbia Chinook stocks, 37.1% West Coast US, 5.1% Southeast Alaska and Gulf Coast, 2.5% Cook Inlet and no contribution from Kodiak Chinook stocks to the harvest.

A direct comparison of the presented information and contribution estimates to the KMA Chinook harvest is difficult because of specific requirements related to CWT estimates and those generated using GSI. For generating reliable harvest estimates using CWT data, a large marking fraction (number of fish marked/total released) combined with a recommended 20% sampling fraction (number of fish sampled from the total catch) is statistically necessary. In the case of both the Kodiak and Cook Inlet Chinook stocks for the years 1994 and 1997-1999, the number of marked fish from the various hatchery releases was small and when combined with low numbers of

recoveries, the harvest estimates were uncertain or informative at best. For these reasons, the comparisons of the CWT contributions with those generated using GSI are completed using a simple percent contribution to the overall sampled harvest (Table 1). In reviewing the data, the overall stock contributions are reasonably consistent: British Columbia stocks consistently contribute greater than 50% to the sampled harvest, followed by Washington and Oregon stocks and to a lesser extent Southeast Alaska with minor contributions from either Kodiak or Cook Inlet stocks.

Summary and Recommendations

- During all years and sampling periods regardless of the commercial salmon fishery district sampled, British Columbia Chinook salmon stocks dominated the stock composition of the harvest. Estimates of the percent contribution ranged from a low of 30% to a high of 70%, representing harvests of several hundred to several thousand fish.

- Consistently, contributions from stocks originating in Washington and Oregon (Western US stocks) to the commercial harvests ranged from a low of 7.3% to a high of 37% and averaged 28% of the estimated harvest.

- Contributions from Southeast Alaska/North Gulf Coast were in most cases higher than the combined contributions from both Kodiak and Cook Inlet. These contributions also seem to be reflective of periods of higher and lower abundance when comparing contributions from 1997-1999 (higher abundance) to those from 2014-2016 which was a period of lower Southeast Alaska stock abundance.

- The capability of any marine salmon fisheries sampling program to consistently estimate the harvest in a timely manner, of at most several hundred fish over a commercial fishing season within the geographic scope of the Kodiak Management Area, is untenable.

- Given the stock status of both the Kodiak and Cook Inlet Chinook salmon stocks a regime such as that outlined in Proposal 37 is unwarranted. Both the Kodiak (0%-4.5%) and Cook Inlet (2.6%-4.5%) stock contributions to the Chinook harvest are minor.

- It should be noted that for the Cook Inlet stocks harvested within the Kodiak Management area, a majority are hatchery fish produced for marine or in river sport fisheries. A specific brood stock selection (similar life history and migration traits to the wild stock) and marking program are required for a hatchery stock to be employed as a proxy for wild stocks, therefore the Cook Inlet tag recoveries and rates should not be applied to Cook Inlet wild Chinook salmon stocks.

References

Clark, R.A. and P.A. Nelson, 2001. Assessment of Harvests of Cook Inlet-Origin Chinook Salmon in Commercial Fisheries in the Kodiak Management Area, 1997-1999. Alaska Department of Fish and Game Regional Information Report, No. 4K01-38, Anchorage.

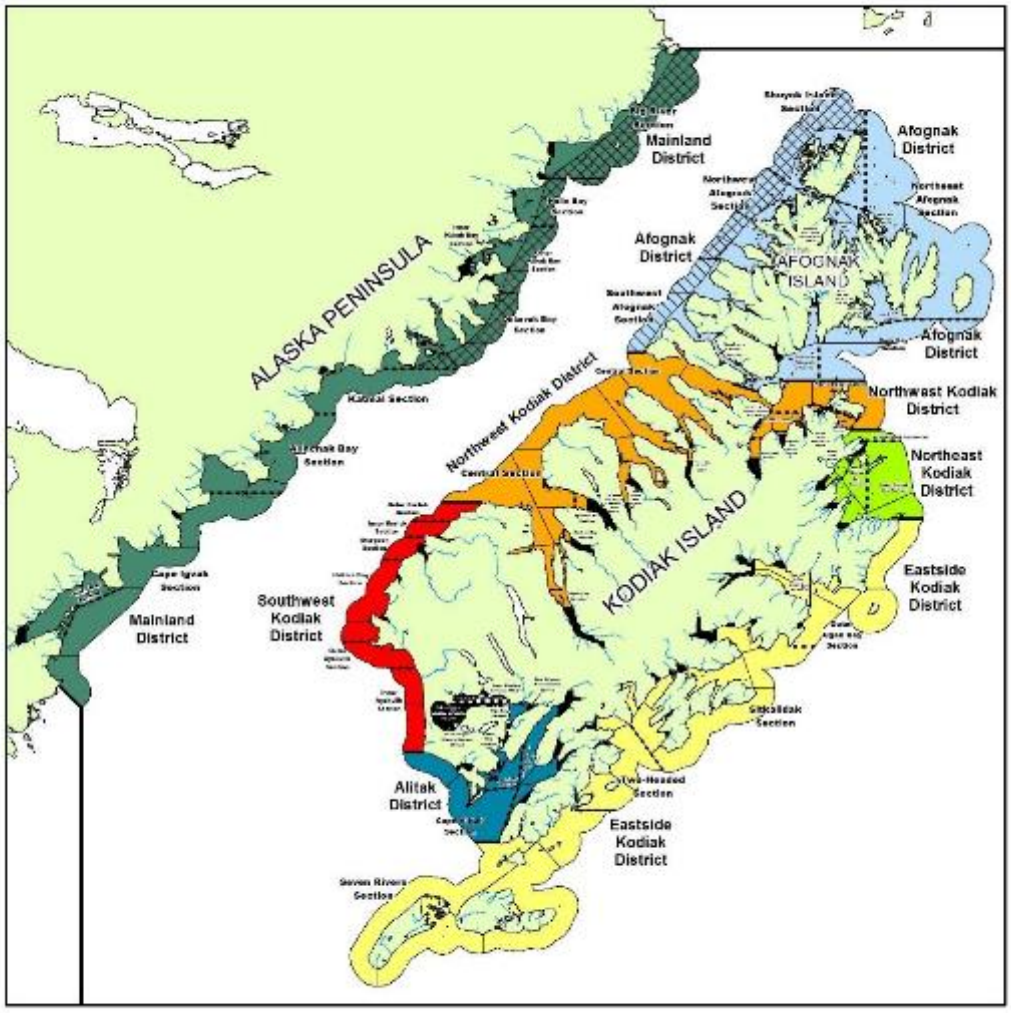
Malloy, L. 1988. Interception of Cook Inlet-Bound Sockeye in the 1988 Kodiak Commercial Salmon Fishery: An In-season management perspective. Alaska Department of Fish and Game Regional Information Report, Kodiak.
Shedd, K. R, K.B. Foster, M. Wattum, T. Polum, M. Witteveen, M. Stratton, T.H. Dann, H.A. Hoyt and C. Habicht. 2016. Genetic Stock Composition of the Commercial and Sport Harvest of Chinook Salmon in Westward Region, 2014-2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-11, Anchorage.
Swanton, C.O. 1997. Incidence and contribution of coded-wire tagged Chinook salmon to Kodiak Management Area Commercial Catches 9 June-6 August, 1994. Alaska Department of Fish and Game Regional Information Report No. 4K97-7, Kodiak.

Table 1. Summary of Chinook Stock Group Harvest Percentages in the Kodiak Management Area.

	Calendar Year						
	1994	1997	1998	1999	2014	2015	2016
Sample size	5,089	6,015	9,191	7,940	3,050	2,775	3,189
Stock Group							
British Columbia	83%	72%	49%	31%	56%	52%	57%
Washington &Oregon	7%	15%	20%	37%	34%	34%	31%
SE Alaska/Gulf Coast	10%	13%	31%	32%	3%	5%	6%
Cook Inlet	0%	present[1]	present[1]	present[1]	2%	2%	4%
Kodiak	0%	n/a[2]	n/a[2]	n/a[2]	1%	1%	1%

[1] CWTs were recovered however insufficient totals to estimate a harvest proportion

[2] no CWTs recovered from fishery sampling



Review of Genetic Studies of Sockeye Salmon Harvests in the Kodiak Management Area

Kodiak Salmon Working Group

Executive Summary

- Recent genetic analyses in Kodiak Management Area provide accurate and precise estimates of sockeye salmon stock proportions and harvest numbers in targeted Westside Kodiak fisheries, during monthly (June, July, August) time periods in 2014-2016. Very limited sampling occurred at Cape Igvak.

- The study was not designed to understand migratory patterns of sockeye salmon through KMA, nor to address finer temporal patterns of non-local stock distribution which might describe rapidly changing abundance of migrating stocks in specific areas. WASSIP results showed that proportions of one non-local reporting group varied by as much as eight fold in weekly samples of Shumagin Island and Dolgoi June fisheries harvests, 2007-2008.

- Harvests of Cook Inlet sockeye in KMA fisheries varied by an order of magnitude between study years and between monthly samples within a year. Incidental harvests in 2015 were particularly divergent, especially for July harvests, during an exceptionally large pink salmon run. The widely divergent harvest proportions of Cook Inlet fish in this three year study suggest no reliable patterns upon which to base specific management actions.

- Susitna bound fish overall represented the smallest component of Cook Inlet stocks incidentally harvested in KMA and accounted for less than

2.5% of total KMA sockeye harvest in 2014-2016 and less than 4.5% of annual harvests in the sampled areas. Due to high estimated harvest rates of Susitna fish in Cook Inlet fisheries (average 38% 2006-2015) and large uncertainties in Susitna escapement estimates, it is unlikely that effects of any “savings” of these stocks in KMA fisheries could be measured with any confidence.

- In 2014-2016, estimated harvest of Susitna fish in Upper Cook Inlet fisheries was 3 fold to more than 40 fold greater than in KMA. Any conservation efforts for Susitna fish should be addressed in Cook Inlet fisheries.

- Data from Cape Igvak is limited to harvests in three temporal periods from two years. Incidental harvest of Cook Inlet fish varies by two orders of magnitude (50 fold) among those strata.

- Evidence suggests that management plans in KMA are working well, as all key sockeye stocks on the Westside are achieving their escapement goals and odd year pink salmon goals are consistently met.

Study Purpose and Design

The purpose of Shedd et al. (2016) was to use Genetic Stock Identification (GSI) methods to estimate temporal stock contribution to select Kodiak Management Area (KMA) sockeye fisheries during 2014-2016 by sampling major sockeye fisheries where significant harvest of salmon occurs (Foster and Dann, 2014, 2015). At its inception, the study intended to meet multiple information needs. Some local fishermen were interested in a

sampling program that could identify particular stocks in area fisheries, especially Alitak-bound fish harvested in Westside fisheries. Fisheries interests outside of Kodiak desired a better understanding of harvests of "non-local" sockeye salmon in Kodiak area fisheries; and area biologists who sought to understand production dynamics of area stocks wanted better stock-specific harvest information for improvement of brood tables, run-reconstructions, and escapement goals for local stocks. Funding constraints resulted in a limited geographic scope for the study.

The work provided accurate and precise estimates of stock-specific harvests for six Westside fishery areas within the KMA over approximately monthly time periods (June,July, August), during the years 2014-2016. Much more limited sampling occurred in Igvak fisheries. Within this scope, it is a robust study which uses state of the art analytic and statistical approaches to generate estimates for sampled areas and times. It has contributed to brood table improvement for area sockeye stocks, especially Karluk and Ayakulik (ADFG, pers. comm).

As the author notes, the study was not designed to understand migratory patterns of sockeye salmon through KMA (Shedd et al., 2016). The design also does not address finer temporal scale patterns of non-local stock distribution which might describe rapidly changing abundance of migrating stocks in specific areas, or address broader questions about sockeye migratory characteristics in and around Kodiak Island outside of sampled areas. Both are important to inform policy debate on allocating harvests from one management area to another.

Finally, there is no information provided on harvest rates to provide context for actual impacts of non-local stock harvest in Kodiak area fisheries. An understanding of stock-specific harvests with respect to run sizes (i.e.,

harvest rates) for those non-local stocks is essential for discussing perceived conservation issues (Habicht et al., 2012).

Sampling

Samples for genetic analyses were gathered at fish processing facilities in Kodiak, Larsen Bay and Alitak. Through close communication with processors, samplers could be in place at facilities when deliveries occurred. Efforts were made to ensure samples only represented fishing in one of the management areas intended for sampling and were taken only from deliveries that could be attributed to the intended area. Deliveries from multiple study areas were not sampled. In Uganik/Kupreanof portion of the NW Kodiak district, where both set gillnet and purse seine vessels contributed to harvests, most samples were taken from set gillnet harvests because seine vessels often had mixed loads (ADFG, pers. com.). Brennan et al., (2017, this volume) point out that gillnets used there are selective for larger fish and sampling from mostly this gear group in Uganik/Kupreanof could bias samples towards Cook Inlet harvests because Cook Inlet sockeye are typically larger fish than Karluk Lake sockeye.

Samples from specific area harvests were collected a number of times, often weekly or more often, throughout the monthly sampling stratum when fish were delivered (Shedd at al., 2016 and ADF&G pers. comm.). Samples were taken on specific dates from fish available on that date. It is not completely clear how samples were randomized within a delivery, but generally, the target sample number (100-400) was taken from the delivery and placed in a separate tote for sampling. These samples represented a bulk sample of tissues from fish for that date. Typically, at least four bulk samples were acquired during monthly periods for each area. Each sample

represents the group of fish delivered on a one or two day period (see Shedd et al. 2016, Appendix B for details).

Post-season, samples for genetic analyses were selected from date-specific bulk samples in proportion to daily harvests for that month, and combined to generate a monthly stock contribution estimate. Previous reviewers of the study have found the general approach of stratified random sampling, sampling in proportion to the harvest and sample sizes to be defensible (Geiger and Quinn, 2017, this volume). To summarize the sampling approach:

- Sampling was adequate for generating monthly estimates of stock-specific sockeye harvest in targeted areas. Samples were collected periodically through the month, and care was taken to ensure that sampled deliveries were from intended fishery areas. Samples selected for analysis were taken from all bulk samples in proportion to the harvest for the month.

- Sampling was not designed to identify times and areas where non-local stocks are most prevalent in KMA or to provide comprehensive information on migration patterns. The study estimated stock proportions and harvests from targeted areas in select Westside fisheries and Igvak using monthly time periods.

- Spatial resolution was limited to major Westside KMA fisheries including Uganik/Kupreanof, Uyak, Karluk/Halibut Bay, Ayakulik/Sturgeon and Alitak, and Cape Igvak in the Mainland District. There are no comprehensive mixed stock analyses for fisheries in Afognak, Eastside District, Olga Bay, Special Harvest

Areas, nor for harvest after August 29, presumed to be mainly local stocks. Authors estimate that sampled areas represented 47-62% of Kodiak sockeye harvest in 2014-2016.

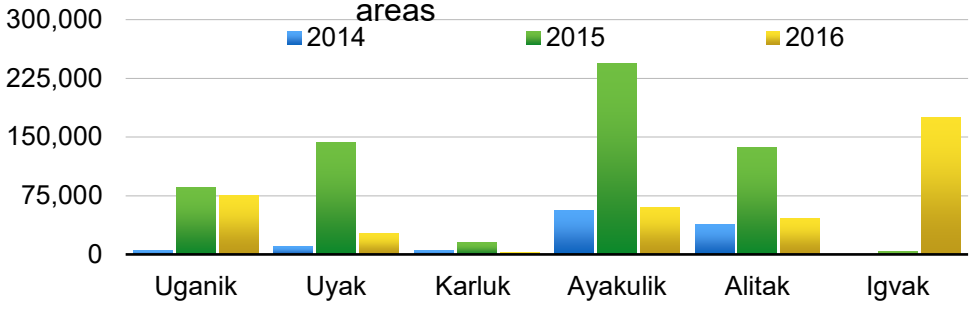
- Temporal resolution was limited to stock compositions for June, July, and August. The periods roughly coincide with fishery management approaches during each period, where early sockeye stocks are harvested in the early stratum (June), pink salmon and sockeye stocks in the middle stratum (July), and late sockeye and pink salmon in the late stratum (August). Harvest stock composition within the monthly periods was not examined.

Results: Variation within and between years

Cook Inlet Stocks

There are very large inter-annual differences among sampled areas in KMA for harvest of Cook Inlet genetic reporting group. Annual estimates of Cook Inlet harvest numbers for all sampled KMA fisheries varied by an order

Figure 1. Annual harvests of Cook Inlet bound sockeye salmon within individual Kodiak Management sub-areas



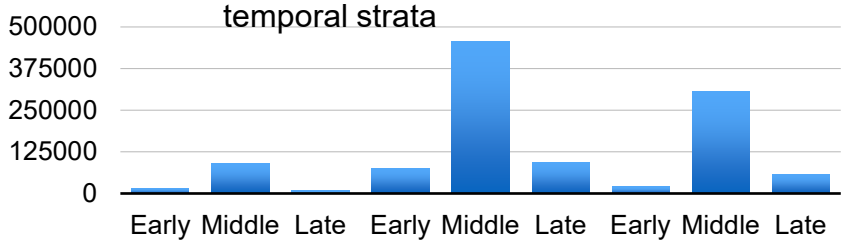
of magnitude between years, especially evident for Uyak, Ayakulik/Sturgeon, and Alitak, where 2015 estimates far exceeded either adjacent year. Uganik/Kupreanof harvests of Cook Inlet fish in 2016 were comparable to

those in 2015 and Igvak had a single, large catch of Cook Inlet stocks in July 2016. Estimated harvests of Cook Inlet reporting group in 2014 were uniformly small for all sampled areas (Figure 1).

It is also clear that incidental harvest of Cook Inlet sockeye stocks in July (middle stratum) were dramatically larger than early or late strata in 2015 and 2016 (Figure 2). This is particularly pronounced for Alitak and Ayakulik/Halibut Bay harvests. For the Alitak District, harvests of Cook Inlet stocks in July (middle stratum) were an order of magnitude higher than early or late strata in all years. Harvests were more than three times larger in 2015 than middle strata in 2014 or 2016 (Figure 3). July (middle stratum) harvests of Cook Inlet stocks in Ayakulik/Halibut Bay were also highest in all years, and much higher in 2015 (Figure 3).

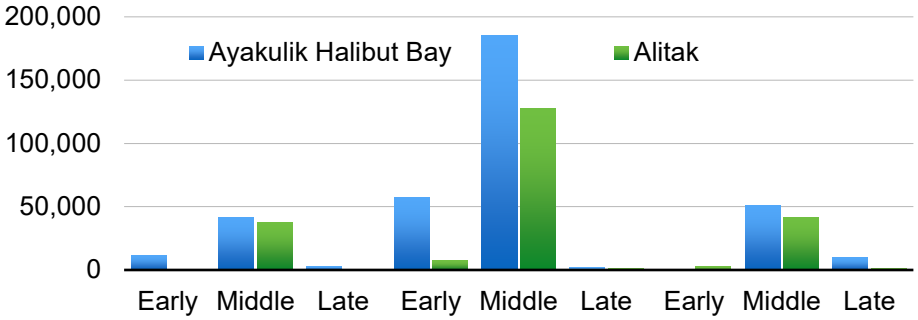
Higher incidental harvest of non-local sockeye in 2015 are likely associated with a very large pink salmon run. At 33 million, pink salmon harvest in 2015 was more than 3 fold larger than 2014 and roughly ten times greater than 2016 (Anderson et al. 2016). The large abundance of pink salmon in 2015 resulted in management actions to increase fishing time. Westside commercial fishing periods in 2015 were extended twice in July and many were open for the majority of August (Anderson et al., 2016). Larger incidental harvests of Cook Inlet sockeye in Westside

Figure 2. Harvests of Cook Inlet bound sockeye salmon in Kodiak Management Area among all sampled areas and years, by temporal strata



isheries during 2015 may partially be explained by pink salmon bundance, reflecting management actions in complex, multi-species fisheries.

Figure 3. Harvest of Cook Inlet bound sockeye salmon by temporal strata, over all years, in Ayakulik/Halibut Bay and Alitak sub-areas of KMA.



While Shedd et al. (2016) is the first genetic stock identification study to focus on KMA, it is modeled after the large WASSIP study which also revealed wide variation in stock specific harvests between and within sampling years, especially for those fisheries known to harvest a mixture of stocks on the South Alaska Peninsula (Dann et al., 2012). The East of WASSIP (EOW) reporting group in that study is a good example. It represents mixed stock analysis assignments made to stock groups beyond Chignik, the Eastern boundary of WASSIP. Specific stock composition of EOW reporting group is unknown, but it likely contains significant and variable proportions of Kodiak, Chignik and Cook Inlet stocks.

- For the Western and Perryville Districts within Chignik Management Area, samples from the same 10 day time interval in July (7/20-7/31) showed

EOW reporting group harvest proportions more than twice as high in 2007 (38.8%) as 2008 (14.9%).

- For the Shumagin Islands June fishery, large differences were also observed for the EOW reporting group proportions among years and within weekly sampling periods. In 2006, among three sampled strata in June, EOW proportions ranged from 18.6% to 43.6%. In 2007, proportions for the same weekly strata ranged between 4.9% and 16.5%. For comparable strata sampled in 2008, the range was 9.4% to 10.6%. Over the three year period, harvest proportions for EOW reporting group in Shumagin June fisheries varied nearly nine fold within the month of June.

- For Dolgoi Area June fisheries, among weekly strata, proportions of EOW reporting group ranged from 17.1% to 39.5% in 2006, 35.8% to 56.2% in 2007, and 7.4% to 27.4% in 2008. EOW proportions varied by nearly 8 fold in Dolgoi within and among years in the WASSIP study (Dann et al., 2012).

Both WASSIP investigators and Shedd et al. (2016) express pointed caution about making inferences beyond their three year study periods. Like any GSI study, the data represent environmental and fishery conditions during those years and changes in relative proportions of reporting groups will be influenced by prosecution of fisheries and ocean conditions (physical and biological) which affect fish migrations. The wide variation observed in WASSIP between weekly sampling intervals among years demonstrates how much stock specific harvests may change within a monthly period. The broad inter-annual variation in WASSIP and the recent KMA study should

emphasize the inherent uncertainty in our understanding of stock vulnerability to commercial fisheries from year to year and within a fishing season.

Results: Measuring Impacts

Shedd et al., (2016) showed that over a three year study period, highly variable numbers of Cook Inlet sockeye salmon were harvested in KMA at some locations and times. However, these data alone provide little insight into impacts of these non-local harvests on Cook Inlet runs. Fishery stakeholders in the WASSIP study, from Area L to AYK, insisted that reporting of stock proportions be accompanied by harvest rates, so that stock-specific harvests could be assessed in relation to their respective run sizes (Habicht et al., 2012). The importance of this exercise is clearly demonstrated by WASSIP data for Outer Port Heiden (OPH) harvests during 2007-2008. Among six sampled time strata for OPH fisheries in 2007-2008, Bristol Bay stocks represented 65%-90% of the sample, while harvest rates on Bristol Bay fish for the same two years were less than 1% (Dann et al., 2012, Habicht et al., 2012). Significant numbers of sockeye bound for Bristol Bay were harvested in OPH, with negligible effect on the overall run.

Though no harvest rates were reported, Shedd et al. (2016) produced analyses to distinguish among four different genetic reporting groups within broader Cook Inlet harvests, including Susitna River, a currently designated stock of concern (Shedd et al., 2017). Overall, Susitna fish represented the smallest component of incidental Cook Inlet harvests in KMA, representing 0.3% to 4.4% of KMA commercial sockeye harvests in sampled fisheries during 2014-2016 (Shedd et al., 2017). They represented only 0.1% to 2.4% of the total KMA sockeye harvest for study years 2014-2016.

Having dispensed with a biased sonar program (Fair et al., 2009), assessment of escapement for Susitna sockeye is now made by three weirs on Judd, Chelatna and Larson Lakes. Based on mark-recapture experiments in 2006-2008, Fair et al. (2009) estimated that combined Chelatna and Judd Lake escapements represent about 42% of Yenta drainage escapements and Larson Lake represents roughly 52% of mainstem Susitna escapement. Escapement goals for these lakes were established in 2017. Over the last decade, goals for Chelatna have always been met or exceeded, Judd was below goal in a single year, and Larson missed three goals by less than 20% (Munro, 2019). Escapements to these index lakes by themselves do not suggest a concern for conservation of Susitna fish. Other Lakes, such as Shell, once estimated to account for 10% of Susitna drainage sockeye production, have been severely impacted by pike predation and Beaver dams, and produce far fewer sockeye than in the past (Shields and Frothingham, 2018).

If management actions were taken to reduce harvest of Susitna bound sockeye in KMA, it is important to consider the fate of these “savings” and how we could evaluate effects of these actions. Any incidental harvest of Cook Inlet stocks avoided in KMA fisheries would be subject to a variety of harvest and natural mortalities before reaching spawning grounds, as they pass through fisheries in Lower and Upper Cook Inlet. Recent estimates of harvest rates on Susitna origin sockeye in Upper Cook Inlet fisheries range widely, but average 38%, 2006-2015 (Erickson, 2017, ADF&G report to Board of Fisheries). A large proportion of these fish would be harvested in Cook Inlet fisheries before reaching their natal streams and lakes.

Importantly, impacts of Susitna bound sockeye harvest in KMA on annual Susitna runs probably cannot be measured with confidence for two

reasons. First, Shedd et al. (2017) used a genetic baseline that includes populations throughout the Susitna/Yentna drainage but does not distinguish fish which may be destined for Judd, Chelatna and Larson Lakes. The lake stocks can be justified as a separate JCL reporting group in Cook Inlet genetic studies (Barclay, 2018). As a result, the relationship between KMA harvest of Susitna reporting group and goals established to index Susitna escapement is unknown because KMA harvests of Susitna stocks cannot be attributed to any of these lakes.

Also, recent mark recapture studies suggest large uncertainties with estimating drainage wide escapements to Susitna drainage (Yanusz et al., 2007). Results from 2006-2008 studies revealed wide 95% confidence intervals (2006, 335,448 - 500,946; 2007, 292,867 - 362,597; 2008, 320,763 - 398,317) for escapements of sockeye to Yenta and Susitna Rivers combined (Erickson, ADFG report to Board of Fisheries). The highest estimated catch for Susitna fish in any KMA stratum, without accounting for additional harvest and predation in Cook Inlet, falls within those confidence intervals. It is unlikely that effects of reducing harvest of Susitna fish in KMA could be detected in Susitna run estimates.

In 2014-2016, estimated harvest of Susitna fish in Upper Cook Inlet fisheries was 3 fold to more than 40 fold greater than in KMA (Barclay, 2018, Shedd et al., 2016). Attempts to conserve Susitna fish must primarily include Cook Inlet fisheries, where savings are more efficiently realized and can be measured.

Cape Igvak

The management plan for Cape Igvak has been in place since 1978. The Cape Igvak fishery is one of only two areas in the state (the other is Southeast District Mainland) in which harvest and escapement triggers from an adjacent management area (both Area L-Chignik) must be met before the fishery can open. For this study, no Igvak samples were taken in 2014 because low Chignik harvest numbers kept the area closed to commercial harvest. In 2015, only the July stratum (middle) was sampled as Igvak was again closed at first due to inadequate harvests in Chignik. Harvest of Chignik fish in Igvak was estimated as 2,059 fish. In both 2014 and 2015, the management plan had its intended effect of keeping Igvak closed or limited when Chignik harvests were low. In 2016, with a stronger Chignik run, an estimated 114,412 Chignik sockeye were harvested in the early (June) stratum. A little more than 10,006 Chignik fish were harvested in July. With only three temporal strata sampled over a three year period, there is no new information on harvest patterns of Chignik fish at Igvak that would support changes to the management plan. While it is clear that some Chignik fish are captured at Igvak (which is reason for the management plan), one data point an order of magnitude greater than the other two reveals dramatic swings in non-local stock abundance. There is no data in this study that supports the presumption in the management plan that 90% of sockeye salmon harvests in Igvak are Chignik bound fish.

Management Plans

The management of KMA fisheries is guided by a number of management plans including the Westside Management plan (5AAC 18.362) and the Alitak District Management plan (5AAC 18.361), most relevant to this

genetics study. While each has very specific management direction for date ranges and particular areas, the central theme is prosecution of traditional fisheries to sustainably harvest early and late runs of sockeye salmon to Karluk, Ayakulik, Upper Station and Frazer Rivers, as well as harvest pink, chum and coho salmon to a variety of locations in July, August and September. The plans have an odd year emphasis for pink salmon management as these are typically larger than even year runs in KMA.

From a biological perspective, successful fisheries management in Alaska is measured through achievement of escapement goals. The Alaska Board of Fisheries pays careful attention to escapement goal performance as a yardstick for sustainable management. For Karluk early sockeye, goals have been achieved or exceeded every year since 2012, and for the late run, since 2010. For early and late sockeye runs to Ayakulik , goals have been achieved every year since 2010. For early Upper Station stock, goals were achieved in 2017 and 2018 and for late Upper Station, goals have been met every year since 2010. For Frazer Lake sockeye, goals have been met every year since 2010. Odd year pink salmon goals in the Kodiak Archipelago have been met or exceeded every year since 2011 (Munro, 2019). Recognizing that scientifically defensible escapement goals are foundational for maximizing yields in future years, it seems clear that KMA fisheries management has been successful and that these management plans are working well.

Literature Cited

Anderson, T .J., J. Jackson, B. A. Fuerst, and A. E. Dorner. 2019. Kodiak Management Area commercial salmon fishery annual management report, 2018. Alaska Department of Fish and Game, Fishery Management Report No. 19-17, Anchorage.

Barclay, A. W. 2019. Genetic stock identification of Upper Cook Inlet sockeye salmon harvest, 2015-2018. Alaska Department of Fish and Game, Regional Information Report 5J19-02, Juneau.

Barclay, A. W., C. Habicht, W. Gist, and T. M. Willette. 2017. Genetic stock identification of Upper Cook Inlet coho salmon harvest, 2013-2015. Alaska Department of Fish and Game, Regional Information Report 5J17-03, Anchorage.

Brennan et al., 2017

Dann, T. H., C. Habicht, S. D. R. Olive, H. L. Liller, E. K. C. Fox, J. R. Jasper, A. R. Munro, M. J. Witteveen, T. T. Baker, K. G. Howard, E. C. Volk and W. D. Templin. 2012. Stock composition of sockeye salmon harvests in fisheries of the Western Alaska Salmon Stock Identification Program (WASSIP), 2006-2008. Alaska Department of Fish and Game, Special Publication No. 12-22, Anchorage.

Erickson, J. (2017) Review of Susitna River sockeye salmon stock status. Oral report to the Alaska Board of Fisheries.

Fair, L. F., T. M. Willette, and J. Erickson. 2009. Escapement goal review for Susitna River sockeye salmon, 2009. Alaska Department of Fish and Game, Fishery Manuscript Series No. 09-01, Anchorage.

Foster, M. B., and T. H. Dann. 2014. Genetic stock composition of sockeye salmon harvested in commercial salmon fisheries of Kodiak Management Area, 2014. Alaska Department of Fish and Game, Regional Operational Plan ROP.CF.4K.2014.24, Kodiak.

Foster, M. B., and T. H. Dann. 2015. Genetic stock composition of sockeye salmon harvested in commercial salmon fisheries of the Kodiak Management Area, 2015-2016. Alaska Department of Fish and Game, Regional Operational Plan No. ROP.CF.4K.2015.15, Kodiak.

Habicht, C., A. R. Munro, T. H. Dann, D. M. Eggers, W. D. Templin, M. J. Witteveen, T. T. Baker, K. G. Howard, J. R. Jasper, S. D. R. Olive, H. L. Liller, E. L. Chenoweth and E. C. Volk. 2012. Harvest and harvest rates of sockeye salmon stocks in fisheries of the Western Alaska Salmon Stock Identification Program (WASSIP), 2006-2008. Alaska Department of Fish and Game, Special Publication No. 12-24, Anchorage.

Munro, A. R. 2019. Summary of Pacific salmon escapement goals in Alaska with a review of escapements from 2010 to 2018. Alaska Department of Fish and Game, Fishery Manuscript Series No. 19-05, Anchorage.

Shedd, K. R., M. B. Foster, T. H. Dann, H. A. Hoyt, M. L. Wattum, and C. Habicht. 2016. Genetic stock composition of the commercial harvest of sockeye salmon in Kodiak management area, 2014?2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-10, Anchorage.

Shedd, K. R., M. B. Foster, and C. Habicht. 2017. Addendum to FMS 16-10: Redefinition of reporting groups to separate Cook Inlet into four groups for the genetic stock

composition of the commercial harvest of sockeye salmon in Kodiak Management Area, 2014?2016. Alaska Department of Fish and Game, Fishery Manuscript No. 17-07, Anchorage.

Shedd, K. R., T. H. Dann, H. A. Hoyt, M. B. Foster, and C. Habicht. 2016. Genetic baseline of North American sockeye salmon for mixed stock analyses of Kodiak Management Area commercial fisheries, 2014-2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-03, Anchorage.

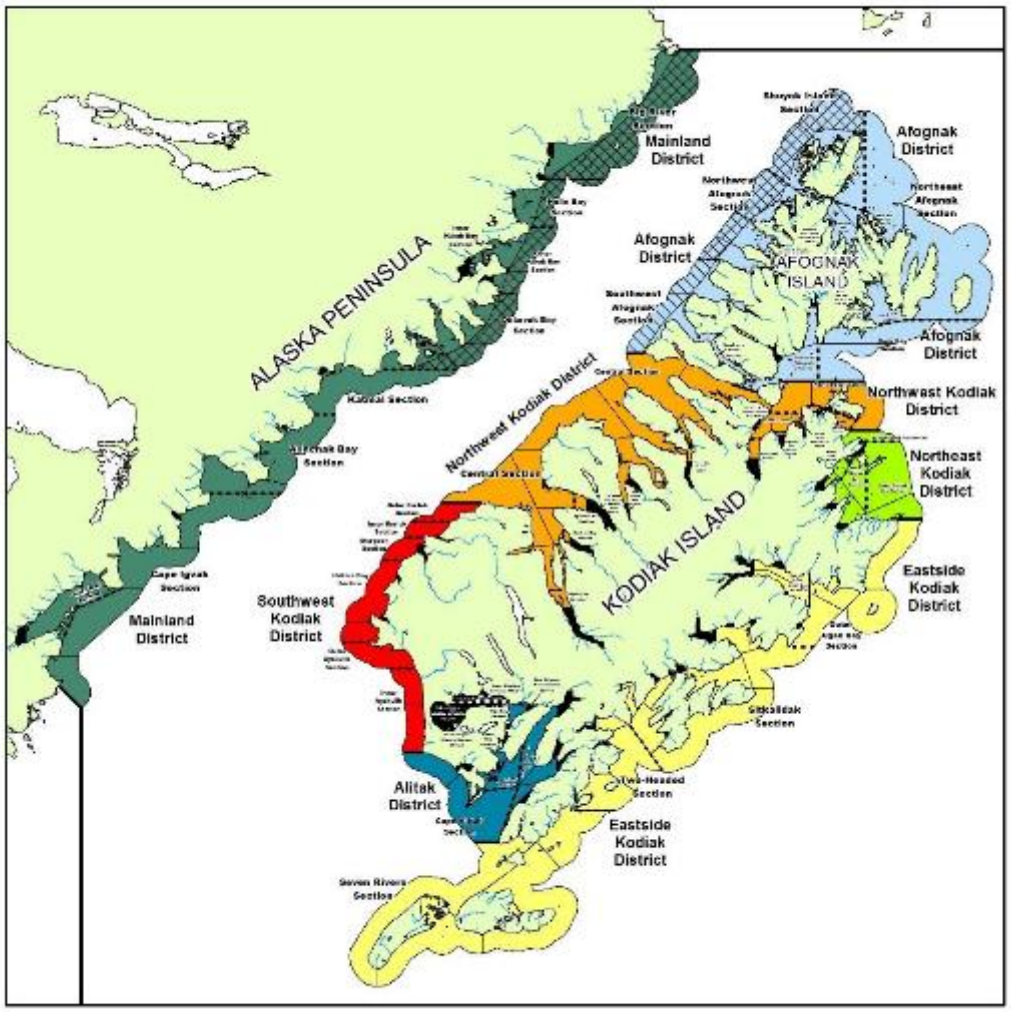
Shedd, K. R., T. H. Dann, M. B. Foster, and C. Habicht. 2016. Addendum to FMS 16-03: Redefinition of reporting groups by combining Ayakulik and Frazer into one group for the genetic baseline of North American sockeye salmon for mixed stock analyses of Kodiak Management Area commercial fisheries, 2014-2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-05, Anchorage.

Shields, P., and A. Dupuis. 2015. Upper Cook Inlet commercial fisheries annual management report, 2014. Alaska Department of Fish and Game, Fishery Management Report No. 15-20, Anchorage.

Shields, P., and A. Dupuis. 2017. Upper Cook Inlet commercial fisheries annual management report, 2016. Alaska Department of Fish and Game, Fishery Management Report No. 17-05, Anchorage.

Shields, P., and A. Frothingham. 2018. Upper Cook Inlet commercial fisheries annual management report, 2017. Alaska Department of Fish and Game, Fishery Management Report No. 18-10, Anchorage.

Yanusz, R. J., R. A. Merizon, T. M. Willette, D. G. Evans and T. R. Spencer. 2011. Inriver abundance and distribution of spawning Susitna River sockeye salmon Oncorhynchus nerka, 2008. Alaska Department of Fish and Game, Fishery Data Series No. 11-12 Anchorage.



Review of Shedd et al. (2016): *Genetic Stock Composition of the Commercial Harvest of Sockeye Salmon in Kodiak Management Area, 2014-2016*

Report to the Kodiak Salmon Workgroup

Harold J. Geiger
Terrance J. Quinn II

September 11, 2017

Executive Summary

The Kodiak Salmon Workgroup contracted us[1] to provide a scientific review of the report by Shedd et al. (2016) entitled *Genetic Stock Composition of the Commercial Harvest of Sockeye Salmon in Kodiak Management Area, 2014-2016*. This review consists of an examination of the scientific merit of the study, its utility compared to previous studies, an interpretation of how the results should be viewed in terms of the magnitude of interceptions of Cook Inlet sockeye salmon in the Kodiak Management Area's commercial fisheries, and thoughts about further investigations that may shed additional insight into Kodiak and Cook Inlet stock compositions of sockeye salmon.

Our primary findings:

1. From the point of view of fishery policy, the most important statistic is the *stock-specific harvest rate,* which is not reported in the Shedd et al. (2016) document for stocks outside the Kodiak Management Area. What is reported is the *stock-specific contribution rate*. Stock composition estimates represent the proportions of a catch that was made by various stocks in a particular spatial and temporal stratum or groups of strata. In contrast, the harvest rate describes the proportion of an annual return that was harvested in a fishery or group of fisheries. Consequently, a fishery may show a large contribution rate for a stock, but the total effect on that stock may be quite small. We illustrate this phenomenon below.
2. The new genetic stock composition approach used in this study is superior to other approaches used in the past, because the real stock composition is estimated rather than inferred from less reliable measurements (e.g., length composition). The use of a Bayesian modeling approach to estimate stock composition is state-of-the-art and allows for the appropriate treatment of random variability due to both random error caused by sampling the fishery mixture and also from the sampling of the contributing stocks.
3. The stratified sampling design used is appropriate with respect to accuracy and precision of stock composition (relative and absolute). It is clear that the authors devoted substantial attention to implementing the sampling design with the intent of obtaining a random or representative sample within combinations of major regional and temporal strata. Further information would be desirable about how the implementation was conducted on finer spatial and temporal scales to justify the assumption of a random or representative sample. For example, how was an individual fish selected for genetic sampling and were there protocols established to prevent selecting fish with particular physical characteristics, such as size?
4. Similar to past studies, results from the study revealed substantial variability in stock composition across years, among spatial strata, and among temporal strata. Further study may be desirable to determine if there are consistent patterns in this variability across years, spatial strata, and temporal strata. Continued genetic sampling and analysis in the future would thus be desirable.

Introduction and Overview

We were asked to provide a scientific review of the Shedd et al. (2016) titled *Genetic Stock Composition of the Commercial Harvest of Sockeye Salmon in Kodiak Management Area*. This complex 154-page report describes an extensive genetic analysis followed by a statistical

[1] See brief biographical statement in Appendix A

analysis of the genetic data for Kodiak area fisheries in catch years 2014, 2015, and 2016. The principal genetic tools that were used for this study were the single nucleotide polymorphism, or SNP, approach. Here we will comment on scientific criticisms of the study that appear relevant, we will briefly comment on the various methods and techniques that were used, and we will offer a broad assessment of the significance of the major findings. As we will explain in more detail below, the study appears to have been carefully conducted and the numerical estimates appear to be well crafted and reliable.

The Alaska Department of Fish and Game had previously tried to use scale pattern analysis and an analysis of fish size to estimate the proportion of non-local stocks in the Kodiak Management Area. For various technical reasons neither of these techniques were very successful. In one of the last reports on the attempts to use fish size for this purpose, Vining (1996) wrote, "As the 1995 analysis indicates, this methodology continues to generate only rough estimates, some with little confidence." It is the opinion of Vining that "other techniques, such as genetic stock identification, tagging or scale pattern analysis should be evaluated for use in the future, if more precise estimates of stock composition for sockeye salmon caught within the [Kodiak Management Area] are desired." This leads us to the present genetic study by Shedd et al. (2016).

The genetic analysis of stock mixtures rests on several assumptions. The analysis starts with the definition of a *catch mixture*, because the catch is presumably made up of a mix of stocks. Importantly, the number of contributing stocks must be known, they all must be sampled, and the genetic character of each stock must be established. Next, a representative sample of the catch mixture must be drawn and the genetic character of each specimen in the catch sample must also be established. Finally, a complicated statistical algorithm can then be used to produce an estimate of the proportion of each of the stocks in the mixture by comparing the genetic characterizations of each fish in the catch mixture to the previously established genetic characterization of the contributing stocks.

A complete analysis must include a study of both the accuracy and the precision of the estimates. In this context, *accuracy* refers to the absence of any statistical bias or other kinds of systematic errors that would consistently cause specific stock estimates to be too high or low. Here *precision* refers to errors that are caused by using only a sample from the stock of origin and the catch mixture, rather than an examination of every single fish in the fishery and every single fish in the spawning stocks. Generally, accuracy is harder to study, detect, and control, while precision can generally be controlled by increasing the sample size. Also, precision is usually studied by looking at the variation from one specimen to another in the samples. Precision measures are usually offered in the form of confidence intervals, standard errors, or coefficients of variations.

Sampling Design

The goal of the study by Shedd et al. (2016) is to determine stock compositions of sockeye salmon within the Kodiak Management Area. Consequently, sampling was restricted to the Kodiak Management Area, rather than to the overall range of sockeye salmon in the western Gulf of Alaska. The authors defined six Kodiak spatial strata of interest (called subregional sampling groups) for *sampling* genetic tissues, comprised of (1) Uganik-Kupreanof, (2) Uyak, (3) Karluk-Sturgeon, (4) Ayakulik-Halibut Bay, (5) Alitak, and (6) Igvak. The first five are located around Kodiak Island, while Igvak is part of the mainland district. The Chignik regional reporting group had combined estimates from subregions Black Lake and Chignik Lake. Four other regional spatial strata outside of Kodiak and Chignik were West of Chignik,

Cook Inlet, Prince William Sound, and South of Cape Suckling. The report did not contain justification for this particular choice of spatial strata, but suggests that considerations included areas with active management and those that are used in run reconstructions to aid management.

One confusing area is that several spatial scales are referred to in the report. For *reporting* purposes (instead of *sampling*), there are a total of 14 subregional *reporting groups* listed on page 2 that constitute the entire western Alaska area. The report designates ten of these groups as *subregional reporting groups* within the Kodiak (8 subregions) or Chignik (2 subregions) *regional reporting groups*. Six regional reporting groups including those outside of Kodiak and Chignik are listed in the tables, with subregional breakdowns for the 8 Kodiak subregions and the 2 Chignik subregions. In the end the system does seem to be consistent; however, we recommend a simpler and clearer description of spatial divisions. *These definitions of spatial strata must be understood to understand the tables and figures of results, which include both regional reporting groups and subregional reporting groups.*

The report indicates that temporal strata are also considered in combination with the spatial subregional strata: Early, Middle, and Late (see page 3 in the Shedd et al. (2016) report. The temporal strata are consistent with patterns that have been observed in past studies.

The sample size goal was to extract 380 tissue samples from each time-area stratum; no reference was provided for this number. The sampling within temporal strata was intended to be proportional to daily abundance. When this was not possible, the total sample size was obtained by sampling days with sufficient additional samples at random until the total of 380 was achieved, a reasonable approach.

We could not determine if sampling was representative within spatial strata, although the intent of the authors appears to be sampling proportional to harvest, a reasonable goal. It would be helpful to have a brief description elaborating the protocol used to achieve this goal.

The sampling design most appropriate for multiple strata with high variation among strata, to obtain high precision and accuracy, is stratified random sampling (Thompson 2016). In the future it would be desirable to show that high variation is present and the improvement in precision by using stratification over simple random sampling. One advantage to using a proportional allocation of sample size with respect to within stratum variation is that different choices for strata are not likely to produce inaccurate estimates. Nevertheless, it is not necessary to use proportional sampling to justify the use of stratified sampling in terms of accuracy, as long as a representative sample is obtained within each stratum. In particular, the use of a fixed sample size of 380 for all spatio-temporal strata is completely acceptable. (Although it may not be the most efficient allocation scheme, it does not induce estimation bias.)

The use of stratified random sampling also has a desirable product in that both relative and absolute stock compositions can be estimated both for individual strata and for combinations of strata, including that portion of the entire Kodiak Management Area that was sampled (not every single fishery was sampled). The main reason for this ability is that catches are known for all spatio-temporal strata. This is one fundamental principle that makes estimation across strata intuitive, accurate, and precise, because relative stock compositions are projected to the total catch to get absolute stock compositions by strata that can then simply be summed across a set of strata of interest.

An additional feature of the sampling design is a set of data quality control procedures regarding the genetic data to avoid the inclusion of erroneous data into the analysis (pages 8–9). Thus, we were unable to uncover any appreciable flaws in sampling, genetic data processing, or genetic analyses in the study.

In summary, we believe that the overall sampling design of using stratified random sampling is appropriate for the genetic analysis of estimating stock composition of sockeye salmon in the Kodiak Management Area. Further studies should be done to consider alternative stratification choices both within space and time and to justify the sample size goal of 380 samples per stratum.

Policy Issues and Stated Goals for the Study

In the introduction of the Shedd et al. (2016) report, the reader finds that the stated purpose of the study was to "sample the major sockeye salmon commercial fisheries in marine waters of [the Kodiak Management Area] from June through the end of August and use genetic mixed stock analysis (MSA) to estimate stock compositions and stock-specific harvests." Later in the report, the reader finds this statement about the goal of the project: "The overall goal of this project is to provide information that will be useful for reconstructing runs, building accurate brood tables to define escapement goals, and refining management by identifying spatial and temporal harvest patterns of *local* and *nonlocal* stocks (emphasis in the original)." Later, the reader finds four stated objectives, including "report [genetic mixed stock analysis] results of stock-specific harvests of sockeye salmon sampled from *selected* commercial fisheries in [the Kodiak Management Area], 2014—2016 (emphasis added)," and "characterize where stocks were harvested from *select* commercial fisheries (again, emphasis added)." This report did not have the express purpose of making arguments regarding allocation decisions by the Alaska Board of Fisheries.

Regardless, the study does conclusively demonstrate that sockeye salmon bound for Cook Inlet were caught in some times and in some areas in the fishing years studied. In the case of the Kodiak Area, there really was no reason to believe that the commercial harvest was made up of only single stocks that originated in the Kodiak Management Area. That is, a finding of rich stock mixtures in at least some times and areas should not have been surprising. There have been many long-standing questions about the degree to which stocks are mixed in the Kodiak Management Area. Summarizing historical tagging studies, Barrett and Swanton (1991) report that sockeye harvests in the North Shelikof Strait in the 1940s, 1970s, and 1980s ranged from 30% to 100% Kodiak fish and 0% to 59% Cook Inlet-origin fish. Moreover, Barrett and Swanton concluded there were large numbers of Cook Inlet bound fish in the North Shelikof Strait fishery in July of 1990.

Contribution Rate Versus Harvest Rate

There are two important rates or proportions that can be derived from stock composition analysis and discussed before policy-making bodies, such as the Alaska Board of Fisheries: the *contribution rate* and the *harvest rate*. These two statistics have very different significance to management. These two rates have often been confused in conversations among fishermen, in testimony before the Alaska Board of Fisheries, and in conversations with members of the press. The percentage that each stock makes up in a mixture of stocks is called the *contribution*

rate (or sometimes the *stock proportion*). For example a fishery may have harvested 50 fish, and 40 of those fish might be from Stock A, with 10 fish from Stock B. Then the *contribution rate* of Stock A is 80%=(40/50)100%. For the purposes of management that could be either high or low. But if the contribution rate was 80%, then this does *not* mean that 80% of the stock was harvested; a harvest rate can be estimated only with abundance or run-size information for the stock of interest.

A large number for the contribution rate is not necessarily important to management, but it could be. If the original size of Stock A was 10,000 fish before this harvest, then the *harvest rate* on Stock A in the catch mixture would be 40/10,000 = 0.4%—which may be considered insignificant. Alternatively, if the original size of stock A was only 150 fish before the harvest, then the harvest rate would be 40/ 250 = 27%—which would usually be considered significant from a management perspective. Although moderate-to-large contribution rate statistics can lead to misplaced anxiety or even outrage, the most important statistic for management policy is the harvest rate, which is the rate that is most clearly related to the population dynamics of a stock.

Technical Comments on Bayesian Analysis and Uncertainty Measures

The statistical analysis was carried out using the Bayesian method of Pella and Masuda (2001). We contend that this method is a reasonable approach with several advantages over the more traditional *maximum likelihood* approach. As this is a Bayesian approach, there are some differences between the interpretations of the measurements that may be confusing and unnecessarily tedious to some readers of the Shedd et al. (2016) report. In the method of Pella and Masuda (2001), the unknown contribution rates (or stock mixing proportions, as they call them) are treated as unknown random variables rather than constant and unknown parameters in the maximum likelihood approach. The analysis proceeds by simulating the probability distributions of these random quantities, with the genetic data used to help develop these distributions.

In a Bayesian analysis, uncertainty in stock contribution rates is frequently displayed by the use of *credible intervals* rather than *confidence intervals*. For example, in Table 3 of the Shedd et al. (2016) report, for the Kodiak reporting group the 90% credible interval runs from 80.9% to 88.1%. The correct interpretation of this interval is that given all of the stated assumptions, *the probability is* 90% that the true value is found between 80.9% and 88.1%, given a list of assumptions. Many people, incorrectly, think this is exactly what a 90% confidence interval is, but this is a mistake for some technical, statistical reasons. For the purposes of readers of this report, we note that the Bayesian results will often closely approximate the more traditional results (Pella and Masuda 2001), so that there should be no harm in simply interpreting the Shedd et al. (2016) credible intervals as the more familiar 90% confidence intervals to investigate uncertainty in the stock composition estimates. While every one of the assumptions that underpin the analysis is probably not strictly true, these intervals do seem to be a very reasonable guide to the precision in the estimates. Based on the reported credible intervals and based on the assumptions stated in the report, the Shedd et al. (2016) estimates appear to be both accurate and precise enough for the purposes of the study.

The Results

In trying to understand the results of the analysis, readers of the Shedd et al. (2016) report may find Figures 8 through 19 helpful, especially when paired with the maps provided in Figures 1–7. Figures 8, 10, 12, etc. (the even-numbered figures) show the estimated contribution rates (or stock mixing rates) for stocks using two levels of detail for the authors' *subregional* and *regional reporting groups* mentioned above. These estimates are then reported by specific time-area catch strata. At the highest level of aggregation there are six regional reporting groups, or what might be considered stocks in the broadest sense: (1) West of Chignik, (2) Chignik, (3) Kodiak, (4) Cook Inlet, (5) Prince William Sound, and (6) South of Cape Suckling. These groups may be the most useful for discussions about fishery management policy. Additionally there are estimates for 10 specific subregional reporting groups, or what might be considered stocks in a more narrow sense, in the Westward Region, and these estimates may be more useful for actual managers or to look at the reasonableness of some of the estimates. Similarly, the odd-numbered figures (Figures 9, 11, 13, etc. in Shedd et al. (2016)) have the stock contribution rates re-expressed as the stock-specific *number of fish harvested* (compared to rates in the previously mentioned figures) in the mixtures.

The usual pattern in these figures is that the majority of the fish harvested in each time-area grouping originated in the Kodiak management area. There are some notable exceptions, especially in 2015. For example, in the Ayakulik-Halibut Bay area, a large fraction of the fish were classified to be of Cook Inlet origin, especially in 2015 during the July 4 to August 1 period (Figure 14 in the report by Shedd et al. (2016)). When viewed in terms of numbers of fish, rather than proportions, the effect looks even stronger (Figure 15). In the Alitak district the catches of fish classified to Cook Inlet exceed the number of fish classified to the Kodiak area in two years: 2015 and 2016. Here too, the effect looks even stronger when views as the number of fish harvested 2015 (Figure 17). However, when summing over time and area, in all study years fish of Kodiak area origin dominate the catch, although catches of Cook Inlet-origin fish increased in 2015, and to a lesser extent, remained high in 2016, when compared to 2014 (Figure 20 in Shedd et al. (2016)).

Questions about why the harvest of Cook Inlet fish might be higher or lower in specific times or areas are beyond the scope of this review. One obvious question is could this variation in the proportion of Cook Inlet-origin fish be due to variation in the sizes of sockeye salmon runs in Cook Inlet?

To get at this question we simply ignored Lower Cook Inlet and brought together run size estimates for Upper Cook Inlet (Alaska Department of Fish and Game, retrieved August 17, 2017), together with the Shedd et al. (2016) estimates of the harvest of Cook Inlet bound fish in the Kodiak Management Area (taken by eye from Figure 20 or from Tables 67–69). As a point of reference, Stopha (2017) projected that approximately 0.3 million sockeye salmon would be returning to hatcheries in Lower Cook Inlet 2017. We assume that the times and areas sampled by Shedd et al. (2016) represent areas where interceptions of Cook Inlet fish would have been considered to be most likely, although we do not know that is true. Here again, as a point of reference, the total fish accounted for by the six Regional Reporting Groups in Tables 67–69 was about 50%–60% of the total reported harvest for the Kodiak Management Area for the three study years (catch numbers from Munro 2015 and later reports in this series). Even though not all times and areas in Kodiak Management Area were sampled and even though there was some sockeye salmon production in Lower Cook Inlet, we expect that the Shedd et al. sockeye salmon catch estimates of Cook Inlet bound fish caught in the Kodiak Management Area divided by the estimated Upper Cook Inlet run size to provide a crudely reasonable—

even if slightly too low—approximation to the harvest rate on Cook Inlet-origin fish harvested in the Kodiak Management Area (Table 1).

Although there are only three years available for comparison, it does not appear that changes in run size explain the difference in harvest rates on the Cook Inlet stocks. The highest harvest rate on Cook Inlet stocks was in 2015, the year with the highest in-Inlet run size among the three study years, but the second highest harvest rate is on the year with the lowest run size (Table 1 below).

Table 1. Upper Cook Inlet run size in millions of sockeye salmon **(A)** (from ADF&G), the estimated harvest of Cook Inlet-origin sockeye salmon caught in the Kodiak Management area in millions of fish **(B)** (From 67–69 in the Shedd et al. (2016) report), and the approximate harvest rate (estimated harvest in the Kodiak Management Area divided by the in-Inlet run size plus the harvest in the Kodiak Management Area) on Cook Inlet-origin sockeye salmon in the Kodiak Management Area **(C)**.

	(A)	**(B)**	**(C)**
	Cook Inlet run size	Cook Inlet catch in KMA	Approximate harvest rate
Year	(millions)	(millions)	in KMA
2010	5.71		
2011	8.68		
2012	6.46		
2013	5.74		
2014	5.54	0.1	2%
2015	6.29	0.6	9%
2016	5.04	0.4	7%

Another important question: were the harvests of Cook Inlet-bound sockeye salmon excessive? Though this is a policy judgment, rather than a scientific question, we note that in the years 2014-2016, the estimated *harvest rate* ranged from 2% to 9%, and did not reach or exceed 10% in any year in the study (Table 1). Some might point out that the way we calculated the harvest rate under-represents its true magnitude—and the estimates in Table 1 very well may be too low. Even so, it would be highly unlikely we have underestimated it by a factor of 2, meaning that the median harvest rate over the three study years would have been almost surely less than 15%, and probably considerably less.

Are there areas where the proportion or numbers of Cook Inlet-origin sockeye salmon are higher than in other areas? Figures 22, 23, and 24 in the Shedd et al. (2016) report are useful for speculating about this question—although it is really impossible to establish a trend with only three years of data. Notice that the area with the highest number of Cook Inlet-origin fish was Ayakulik-Halibut Bay in 2014 and again in 2015. However, in 2016 the number of Cook Inlet-origin fish in this district was much reduced from the previous year, and a larger number of Cook Inlet-bound sockeye salmon was caught in the Igvak area—which had previously been an area with very few Cook Inlet-origin fish harvested.

When time is brought into the discussion the situation also appears murky. The proportion of Cook Inlet-origin fish caught in the Uyak area is relatively low in all sampling periods in 2014 (Tables 15, 16, and 17 in the Shedd et al. (2016) report, yet the proportion rises to relatively high levels (54% and 32%) in the second and third sampling periods in 2015 (Tables 20 and 21). Then in 2016, the proportion was much reduced, with over 80% of the fish harvested in each period in this catch area belonging to the Kodiak reporting group (Tables 23, 24, and 25). This observed variation shows the danger in looking at just three years and thinking that one sees a trend. Further sampling and study is warranted to understand patterns of temporal variation.

The proportion of Cook Inlet-origin fish in the Ayakulik-Halibut Bay area is relatively low (less than 8%) in the first sampling period (June 1 to June 27) in 2014, but that this rises to 24% in the second period (June28 – July 25) of that year, and then falls to about 5% in the last sampling period of that year (Tables 39, 40, and 41). However, in the next year this proportion starts high in the first period (28%), rises to 48% in the second period, and then drops to less than 10% in the last period (Tables 43, 44, and 45). In 2016, the first period contains essentially all fish originating from the Kodiak Management Area (>99%; Table 47), but the proportion of Cook Inlet-origin fish again rises in the second period to nearly 42%, and remains high at 28% in the third period (Tables 47, 48, and 49). A person focusing on the similarities would note that the second sampling period for this district was consistently high in all three sampled years, and that is correct. However, someone focusing on the large year-to-year variation in the proportion of Cook Inlet-origin fish would correctly point out that with three data points it is premature to speculate that this pattern will continue into the future.

Final Comments

The Shedd et al. (2016) report is generally well written, organized, and it offers a reasonable amount of specific details about the actual genetic and statistical analyses. While it is impossible to judge the care, attention to detail, and technical skill that actually went into actual genetic analysis from the written page, the report demonstrates a great deal of technical sophistication. The sections on "Laboratory Quality Control" appears to demonstrate that the authors did take reasonable care to detect and report on obvious mistakes. The Alaska

Department of Fish and Game's Gene Conservation Lab has an excellent reputation for this kind of work. It would be extremely surprising to find that many, if any, outright mistakes were made in either the genetic or the statistical analyses.

The estimates in the Shedd et al. (2016) report seem quite reasonable. Catches were generally dominated by fish that originated within the Kodiak Management Area. Although there are some exceptions, a finer-scale examination shows catches were generally dominated by stocks that originated near the area of harvest. The Shedd et al. (2016) report is technically sophisticated and it contains features that we have found are indicative of a study that is carefully conducted. We found no reason to think that there were any large inaccuracies in the study, and the reported measures of precision provide evidence that the reported estimates are trustworthy and suitable for their intended purposes.

Finally, we note that the estimated harvest rate on Cook Inlet-bound sockeye salmon were below 10% in each year, and substantially below 10% in one year. These harvest rates generally agree with what previous, less accurate studies, have suggested. However, with only three years of measurements, with a large fraction of the catch not sampled, and with large annual variation in those measurements (much larger than the error obtained from the credible intervals), it is very hard to conclude that these results bracket the range of what to expect if the study were to be repeated, or to conclude that these results represent what would happen in a "typical year" (if there ever is such a thing). We recommend that the genetic analyses in this study be conducted to better understand the apparently real variation in stock contribution estimates (both rates and harvests).

These estimates in Shedd et al. would have been more useful for policy discussions if they could be recast in terms of harvest rate rather than contribution rate. In fairness, we note that this was not one of the stated goals for the study, but this appears to be a subject that needs to be addressed in the future. We have tried to crudely approximate the harvest rate using information that was easily accessible to us. While our specific harvest rate estimates can be easily criticized, it is clear that the harvest rate was probably much less than 10% in most study years and almost surely less than about 15% in each year of the study. In the future, we recommend sampling in some of the time and area strata that were not sampled in 2014–2016, or else we recommend some discussion of why specific time-area strata can be assumed to have very low contribution rates for stocks outside the Kodiak Management Area.

Acknowledgments

We thank Heather McCarty for her help in proposing this review and guidance into the scientific and management issues involved.

References

Barrett, B.M. and C.O. Swanton. 1991. Origins of sockeye salmon in the Kodiak Management Area North Shelikof Fishery, 6 July through 25 July, 1990. Regional Information Report 4K91-3. Alaska Department of Fish and Game, Kodiak, Alaska.

Munro, A. R., editor. 2015. Run forecasts and harvest projections for 2015 Alaska salmon fisheries and review of the 2014 season. Alaska Department of Fish and Game, Special Publication No. 15-04, Anchorage.

Pella, J. and M. Masuda. 2001. Bayesian methods for analysis of stock mixtures from genetic characters. Fishery Bulletin 99:151–167.

Stopha, M. 2017. Alaska fisheries enhancement annual report 2016. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J17-04, Anchorage.

Vining, I. 1996. The use of average weight to estimate the level of harvest of non-local sockeye salmon within the Kodiak Management Area during July 6–25, 1983–1995. Regional Information Report 4K96-28. Alaska Department of Fish and Game, Kodiak, Alaska.

Appendix A – Biographical Statements for the Authors

Harold J. Geiger is the chief scientist for the St. Hubert Research Group, a small consulting company in Juneau, Alaska. He previously worked for the Alaska Department of Fish and Game, holding several positions on the salmon research staff of the Division of Commercial Fisheries before retiring in 2007. He held the position of Chief Biometrician in the late 1990s and was the Salmon Research Supervisor for the Southeast Region in the early 2000s. He holds a Master's degree in Statistics from Oregon State University and a PhD from the College of Fisheries and Ocean Sciences at the University of Alaska Fairbanks.

Terrance J. Quinn II, Ph.D. has been Professor of Fish Population Dynamics in the Fisheries Department, College of Fisheries and Ocean Sciences, University of Alaska Fairbanks for 32 years. He obtained his Ph.D. in Biomathematics from the University of Washington in 1980. Dr. Quinn's research focuses on fish population dynamics; estimation of fish and whale abundance; sampling theory; and renewable resource management systems. He is the co-author or co-editor of 4 books and over 100 scientific publications and has shepherded about 40 students through their post-graduate careers. He has been a member of the Statistical and Scientific Committee of the North Pacific Fishery Management Council since 1986 and was a former chair of that body. He is a former member of the Ocean Studies Board of the National Academy of Sciences and served on five of their committees, including two as chair or co-chair. He is an Associate Editor of the Canadian Journal of Fisheries and Aquatic Sciences.

Appendix B: Some Comments on Stock Mixture Analysis

The earliest techniques for developing these estimates were based on simply capturing migrating salmon, tagging them with a visible tag, and then looking for the tags on spawning fish. By comparison, this is a crude technique as it is hard or even impossible to control for how much effort went into looking for tags. That is, a stock with a small contribution to the mixture could result in a large fraction of the recovered tags if, for example, there was a counting weir on the spawning stream of that stock.

A technique that is somewhat more sophisticated is based on an analysis of scale patterns, and this technique was used extensively in the 1980s and 1990s. The technique was based on the assumption that fish originating from different systems had different growth patterns, which would be represented on the scales of the fish. A large sample of scales needed to be collected for each stock, each year. Then a very large (often over 100 measurements) can be used to characterize the scale pattern for that stock, as the growing conditions that affect the scale patterns change from year to year. A complex statistical algorithm (called a linear discriminate function) is used to look for the specific measurements that show the most differences among

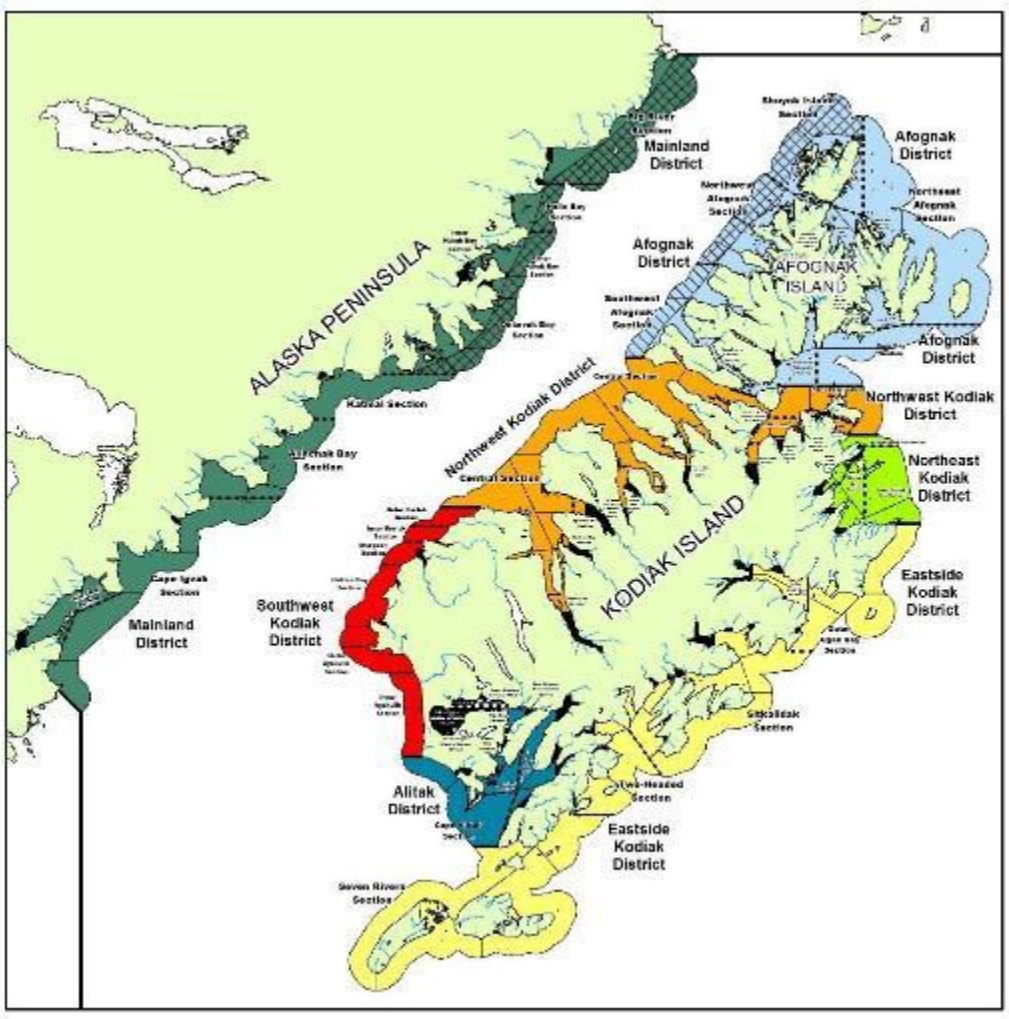
stocks. The results from this discriminate function can then be used to classify fish in the fishery mixture to the stock that most likely produced it.

In Lynn Canal in Southeast Alaska, scale patterns were used to estimate the proportions of Chilkat and Chilkoot Lake sockeye salmon in a mixture to both actively manage a gillnet fishery during the fishing season and to study the productivity of the stocks after the fishing season. This was an ideal situation as the number of stocks was small and the patterns were quite different. As the number of stock in the mixture increased beyond just a few, or as the growing conditions among the stocks were more similar, scale pattern analysis estimates become uncontrollably imprecise, and the accuracy of the estimates would also degrade.

In the 1990s, genetic tools showed obvious advantages over other techniques. The first genetic techniques are sometimes called the allozyme techniques. Although these were time consuming and expensive, one of the main advantages was the individual stocks no longer needed to be characterized each year, as the genetic character of the stock changed slowly, if at all. Later, microsatellite techniques replaced allozyme techniques for a number of technical reasons. Finally, the SNP (Seeb et al. 2011) approach, used in this study, is usually thought of as the current state of the art and most cost-effective method of conducting a complex stock mixture analysis.

Reference

Seeb, J. E., G. Carvalho, L. Hauser, K. Naish, S. Roberts, and L.W. Seeb. 2011. Single-nucleotide polymorphism (SNP) discovery and applications of SNP genotyping in nonmodel organisms. Molecular Ecology Resources, 11: 1–8. doi:10.1111/j.1755-0998.2010.02979.x



Structure and Function of the Kodiak Management Area Salmon Fisheries, A Summary and Update of Brennan et al. 2017.

Kodiak Salmon Working Group December 2019

Structure and Function of Kodiak Management Area Salmon Fisheries, a Summary and Update of Brennan et al. (2017)

by the Kodiak Salmon Work Group

In late 2017 a trio of former Kodiak area management biologists, with 34 years of cumulative, consecutive experience, authored a detailed report on the salmon fisheries and various salmon fishery management plans that pertain to the Kodiak management area (KMA). Their report was prepared in light of the potential effects of an agenda change request (ACR 11) that had been submitted by the United Cook Inlet Drift Association (UCIDA) for the Alaska Board of Fisheries work session in October 2017.

ACR 11 presented UCIDA's "umbrella plan" for Kodiak fisheries, and was essentially the same as the "umbrella plan" that is laid out in Proposal 66 currently in front of the board. Thus, the Brennan et al. report is as relevant today as it was two years ago. This report by former area management biologists also provides information that applies to the board's consideration of Proposals 64 and 65.

The main conclusion from Brennan et al. is that adjustments to the longstanding KMA management plans, such as those requested by Proposals 64-66, are not justified and would drastically damage the Kodiak salmon fisheries while providing little to no meaningful benefit to Cook Inlet fishermen or stocks.

In essence, imposition of management actions outlined in Proposals 64-66 would violate the board's Policy for the Management of Mixed Stock Salmon Fisheries (5 AAC 39.220) and the board's Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222), and would not be consistent with the board's Allocation Criteria (AS 16.05.251(e)).

Specific Conclusions

The new mixed stock analysis (MSA), or genetic stock identification (GSI) study, on Kodiak sockeye salmon fisheries authored by Shedd et al. (2016) has limited applicability, and is not sufficient reason to change current KMA management. The salmon fisheries in the KMA are long-standing mixed stock, multi-species fisheries, with a variable and unpredictable component of nonlocal sockeye salmon.

The mixed stock nature of KMA salmon fisheries, including the incidental harvest of non-local, Cook Inlet sockeye stocks, is well known, not new.

There are no conservation emergencies for salmon and salmon fisheries within the KMA, including non-local sockeye stocks bound for Cook Inlet or Chignik.

Results of the 2014-2016 genetic MSA report did not provide sufficient cause for the board to accept ACR 11 and do not now support passage of proposals such as Proposals 64-66. Alteration

of the KMA salmon management plans is not justified under application of the board's Mixed Stock Salmon Fisheries Policy or the Sustainable Salmon Fisheries Policy.

Pertinent Considerations

Based on location and oceanography, mixed stocks of Pacific salmon migrate through the Kodiak management area, and are harvested in KMA salmon fisheries. The mixed stock nature of KMA salmon fisheries and the KMA harvest of nonlocal, Cook Inlet-bound sockeye have long been known and accounted for.

KMA commercial salmon fishery management plans are complex and were developed with the potential for harvest of nonlocal sockeye in mind. With early-run sockeye, pink and chum, late-run sockeye and coho salmon runs showing at different systems at different times through a long fishing season, a blended management approach was formulated.
Targeting of nonlocal salmon was minimized by focusing fishing opportunity on the timing and abundance of local salmon.

In 1978, the Board of Fisheries passed the first Kodiak salmon management plan, the allocative *Cape Igvak Salmon Management Plan* (5 AAC 18.361). In 1987, based on increasing allocative disputes among set gillnet fishermen in the Alitak District, the Kodiak area management team wrote up and brought to the BOF a local stock management plan for the Alitak District.

In March 1990, the BOF considered two main Kodiak management plans. The first was the *Westside Kodiak Salmon Management Plan* (5 AAC 18.362); adopted into regulation was the blended management chronology of the major salmon fisheries in the Northwest Kodiak and Southwest Kodiak Districts.

The second, the *North Shelikof Strait Sockeye Salmon Management Plan* (5 AAC 18.363), was developed as an allocative plan meant to contain KMA salmon fisheries in the North Shelikof area after uniquely high catches of migrating sockeye occurred offshore in Shelikof Strait in 1988. The North Shelikof Plan, plus strict restriction of fishing to within three-miles of shore, precludes any repetition of 1988-style harvests on non-local sockeye, yet still provides for traditional opportunities to harvest high quality local pink and chum salmon. The North Shelikof Plan constitutes a significant contribution of KMA fisheries to the "burden of conservation" for Cook Inlet sockeye stocks.

Mixed stock analysis (MSA, via comparison of average weights and scale pattern analysis) continued on the July North Shelikof sockeye harvest and, in 1993, MSA was expanded to include the entire KMA except for the Cape Igvak fishery. The result was estimates of extremely variable numbers of nonlocal Cook Inlet sockeye stocks in KMA sockeye harvests.

Between 1990 and 1999, five more regulatory management plans were developed by the Kodiak area management team and adopted by the BOF. During those deliberations, the mixed stock nature of KMA sockeye harvests and the variable and potentially large occasional harvest of Cook Inlet sockeye in various places around the KMA were known facts and often discussed.

The negative effects of adopting the UCIDA "umbrella plan" (ACR 11 and Proposal 66) are not presented by the proponents. But, the negative effects would be drastic: they would include extensive KMA fishery closures from late June through July resulting in substantial lost harvest opportunity, reduced salmon product quality, increased gear conflicts, and ultra-conservative management in the face of loss of traditional fishing patterns. The economy of Kodiak would be severely, negatively impacted.

Susitna sockeye are a designated as a stock of yield concern, and is not a conservation concern under present day management of Cook Inlet and KMA fisheries. The Action Plan for Susitna sockeye has not included reducing the harvest from Lower Cook Inlet or KMA fisheries, though it does identify many other sources of concern, such as invasive species (northern pike), loss or alteration of freshwater habitat, change in water quality and quantity, pathogens and freshwater fisheries.

The genetic MSA report (Shedd et al. 2016) shows a snapshot of events, with some significant limitations. The limits are outlined by the authors of the report, and should be heeded. Funding limited the scope of the study, and the study design was not intended to answer many biological and allocative questions regarding incidental KMA catch of nonlocal sockeye. Further, it is apparent that the information provided by the new KMA sockeye genetic MSA may be misused, and may create more uncertainty rather than less.

Some may believe that KMA local salmon stocks could all be harvested within 'terminal' fishing areas or 'inside the capes'. Long experience has shown that allowing salmon to enter the fresher (less saline), warmer, inside waters of the KMA will very quickly lead to loss of quality, or to complete loss to the fishery as the fish home-in and refuse to move out of closed water sanctuaries. Managing salmon escapement to within stated escapement goals would become much more difficult and threaten future stock productivity.

Policy for Management of Mixed Stock Salmon Fisheries and associated findings (93-07- FB):

- The Mixed Stock Policy asserts that the board's preference in assigning a burden of conservation in mixed stock fisheries is through the application of regulatory management plans. The KMA has operated under an interrelated suite of such management plans for decades.
- Each of the KMA regulatory management plans was developed and adopted by the Board of Fisheries with full knowledge of ongoing

incidental harvest of non-local stocks, including sockeye salmon otherwise returning to Cook Inlet.

- The mixed stock nature of salmon fisheries such as those in the KMA was explicitly recognized and accepted by the Board of Fisheries in their findings.
- The very large harvest of presumably Cook Inlet-bound sockeye in Shelikof Strait in 1988 was the one instance where a "new or expanding" fishery has developed in the KMA, and the board took quick action to curtail that type of fishery expansion with the 1990 *North Shelikof Strait Sockeye Salmon Management Plan*, almost 30 years ago.
- KMA commercial salmon fishermen already bear a significant and potentially disproportionately high burden of conservation for Cook Inlet sockeye stocks through the regulations for the North Shelikof Plan. An additional burden of conservation for relatively healthy Cook Inlet salmon stocks should not be prioritized at the risk of harm to KMA fisheries and local salmon stocks.
- The BOF findings assert that "it is not the intent of this policy to create a terminal fisheries preference…" Rather, the board recognized that "stability is an important aspect of [Alaska's] fisheries," most of which "harvest stocks which are mixed".

Policy for the Management of Sustainable Salmon Fisheries:

- The stated goals of the policy include not only conservation of salmon and habitat, but the policy also seeks to ensure "the sustained economic health of Alaska's fishing communities." Moreover, the board will consider "existing harvest patterns" when formulating any fishery management plan. There is no doubt that the significant changes to KMA's long-standing salmon management plans sought in Proposals 64-66 would drastically negatively impact the economic health of Kodiak communities.
- Fortunately, there are no major conservation concerns for sockeye salmon stocks in Cook Inlet, thus the Sustainable Salmon Fisheries Policy is currently accommodated by existing regulatory management plans.
- Regarding the Susitna stock of yield concern, the associated action plan indicates that factors other than the incidental harvest of nonlocal sockeye in the KMA, or even in lower Cook Inlet, are the appropriate focus for action.

The Alaska Board of Fisheries' Allocation Criteria:

- The BOF has adopted directly the statutory language of AS 16.05.251 (e) as its standard for allocation criteria: subparagraphs (1), (4), (5), and (6) are most applicable to consideration of Proposals 64-66: (1) the history

of each fishery, (4) the availability of alternative fisheries resources, (5) the importance of eachfishery to the economy of the state, and (6) the importance of each fishery to the economy of the region and local area in which the fishery is located.

- Regarding the history of KMA salmon fisheries, they have been ongoing for over a hundred years with a recognized incidental catch of migrating, non-local sockeye bound for Cook Inlet. A large suite of regulatory management plans has been enacted to manage fisheries in the KMA, all of which considered and accommodated the variable and unpredictable harvests of mixed and non-local stocks. These harvests have become a part of Kodiak longstanding allocation and opportunity to harvest salmon. Proposals 64-66 would abrogate that recognized history and allocation, and for no apparent benefit.
- Regarding the availability of alternative resources, Proposals 64-66 purport to protect some fraction of the Cook Inlet-bound migration of sockeye salmon through KMA fisheries, but the proposed mechanisms would directly and greatly diminishthe Kodiak fleets' ability to harvest alternative fishery resources such as local pink, chum and coho salmon.
- Regarding the importance of each fishery to the economy of the state, it is clear that the losses to KMA sockeye, pink, chum and coho fisheries caused by adoption of Proposals 64-66 and others, would greatly overshadow the minimal (if even detectable) gains that might accrue to the Cook Inlet fisheries. Thus, there would be a net negative impact to the economy of the state.
- Regarding the importance of each fishery to the economy of the region and local area, it is clear that a very large portion of the economy of Kodiak Island is directly dependent upon the harvesting and processing of sockeye, pink, chum and coho salmon. By contrast, the Cook Inlet sockeye fisheries comprise an important but proportionately less dominant contribution to the economy of Cook Inlet communities, the greater Anchorage area, and the Matanuska-Susitna region. Moreover, the very small (likely undetectable) gains to sockeye harvests in Cook Inlet constitute even that much smaller a contribution to the greater Cook Inlet economy.
- Finally, while not stated explicitly in the language of the Allocation Criteria, there is an implicit requirement of fairness, equity, and proportional benefit and cost for any action taken by the board. In this instance, it is clear that actions to implement Proposals 64-66 would impose costs many, many times higher than any possible calculation of benefit and thus would violate any reasonable standard of fairness or equity.

A Review of Agenda Change Request #11 and the ADF&G Kodiak 2014-2016 Sockeye Genetic Mixed Stock Analysis technical Fishery Manuscript, with recommendations to the BOF.

Compiled By:

Kevin Brennan,

Dave Prokopowich, and

Larry Malloy

Prepared for the Kodiak Salmon Work Group
September 25, 2017

TABLE OF CONTENTS

INTRODUCTION: BOF AGENDA CHANGE REQUEST CRITERIA AND CONSIDERATION OF ACR #11

United Cook Inlet Drift Association has submitted an Agenda Change Request (ACR #11), asking the BOF to consider an out-of-cycle proposal for a new salmon management plan in the Kodiak Management Area, to limit nontraditional harvest of nonlocal sockeye in KMA commercial salmon fisheries.

Normally, Kodiak Finfish issues are addressed during regularly scheduled (on-cycle) BOF meetings; only if the BOF accepts a properly submitted Agenda Change Request (ACR) will unscheduled (off-cycle) BOF consideration be approved. ACRs, reviewed at fall BOF work sessions, must meet the Policy for Changing Board of Fisheries Agenda (5 AAC 39.999). ACR consideration usually requires clear and concise biological concerns. Subsequent allocative considerations receive a lower priority. Application of BOF Criteria and Policies requires that unless there is compelling NEW information, then any allocatively-based ACRs would be denied. Such issues would then come up at the next on-cycle BOF meeting (for Kodiak Finfish that would be the 2019/2020 cycle).

The Criteria for an Agenda Change Request are found in the Alaska Administrative Code (regulations). For this discussion, the pertinent portions of that regulation are as follows:

> 5 AAC 39.999. POLICY FOR CHANGING BOARD AGENDA. (a) The Board of Fisheries (board) will, in its discretion, change its schedule for consideration of a proposed regulatory change in response to an agenda change request, submitted on a form provided by the board, in accordance with the following guidelines:
>
> (1) **the board will accept an agenda change request only**
>
> (A) **for a fishery conservation purpose or reason;**
>
> (B) **to correct an error in a regulation; or**
>
> (C) **to correct an effect on a fishery that was unforeseen when a regulation was adopted;**
>
> (2) **the board will not accept an agenda change request that is predominantly allocative in nature in the absence of new information found by the board to be compelling.**

Based on our review of the new MSA report and ACR #11, our brief responses to these criteria are:

Criteria 1(A): The BOF may accept an ACR for a fishery conservation purpose or reason. However, there isn't a Conservation Concern for any sockeye salmon stock in the Cook Inlet or Kodiak Management Areas. Published ADF&G forecasts for the 2014 to 2016 (GSI study years) and 2017 for Cook Inlet salmon fisheries predicted harvestable surplus for all sockeye stocks. Commercial fisheries were prosecuted in Upper Cook Inlet from 2014-2017, and there is no chronic inability to meet UCI sockeye escapement goals. Susitna sockeye are a Stock of Yield Concern, not a Conservation Concern. A BOF approved Action Plan was developed in 2008 and has been modified with BOF review (more detail is offered below).

Criteria 1 (B): The BOF may accept an ACR to correct an error in a regulation.

We feel there are no errors in current regulations governing the KMA salmon fisheries. This salmon fishery has been identified as a Mixed Stock Fishery, and past studies have revealed similar numbers and percentages of Cook Inlet sockeye present in KMA harvests, as did the new Kodiak sockeye genetic MSA study. KMA regulatory Salmon Management Plans (SMP) were written, discussed, and passed by the BOF with that knowledge.

Should that fact then dictate that nonlocal salmon in KMA harvests be discussed by the Board to consider possible change to KMA commercial salmon fishing regulations, then the BOF may schedule the issue for the on-cycle, regularly scheduled Kodiak finfish meeting. That option also allows for continued study, education, discussion and potential agreement or acceptance by stakeholders. Options and possible courses of action could be discussed among ADF&G researchers and managers.

An error in regulation is more likely with hasty, ill-prepared, unjustified or politically motivated proposed regulation changes. An issue of this importance and complexity deserves adequate consideration prior to changes to traditional and historical fisheries, changes which would also bring severe economic consequences to the Kodiak salmon fishery.

Criteria 1 (C): The BOF may accept an ACR to correct an effect on a fishery that was unforeseen when a regulation was adopted. There hasn't been any "effect on a fishery" demonstrated by ADF&G's new MSA study or report. There was substantial data, yet little to no analyses. The net effect of the KMA harvest of nonlocal sockeye is not new nor has it been demonstrated that it is endangering any sockeye stocks. Perhaps an ADF&G evaluation of the effect of KMA harvest of nonlocal sockeye is needed, and we suggest taking the time to ask the Department that, and other germane questions.

The presence of relatively large numbers of Cook Inlet salmon within KMA commercial salmon harvests during any year cannot be categorized as "unforeseen," for the reasons stated throughout this review. As previously shown, even a measure of the magnitude of the KMA commercial harvest of Cook Inlet sockeye estimated by the new MSA study was clearly demonstrated and reported to the BOF in the early to mid-1990s (over 20 years ago). No negative effects on the nonlocal sockeye stocks have been shown. Unfortunately, many UCI fishermen may hear of the NEW study and expect that the Mixed Stock nature of KMA salmon fisheries was an unforeseen effect.

Criteria (2): The board will not accept an agenda change request that is predominantly allocative in nature in the absence of new information found by the board to be compelling.

Does this new MSA study and report show that there should be new concern for the sustainability or conservation of any Cook Inlet sockeye stock? In the absence of a Biological Concern, what remains are Allocative Concerns. Based on our experiences, we do not believe that the new MSA is new and compelling.

We feel that the BOF should not accept any ACRs regarding KMA nonlocal salmon harvest at fall Board of Fisheries work sessions. Board review of KMA commercial salmon fishery

regulations should remain ON-CYCLE, to next occur during the BOF's 2019/2020 meeting cycle.

We have ISSUES with the ISSUES PRESENTED by UCIDA in ACR #11. There are misstatements and untruths contained in the ACR explanations and descriptions. For clarity, we comment on the UCIDA responses to the questions posed on the Agenda Change Request Form:

ACR #11 - Question 1: UCIDA asks for the adoption of a new regulatory management plan for the KMA. As stated, we do not believe that the Criteria for an Agenda Change request have been met.

ACR #11 Question 2: UCIDA states that the problem is "the harvest of Cook Inlet and other non-local salmon stocks in the Kodiak Area".

No evidence of harm or any problem with UCI sockeye stocks is shown or postulated. It appears that UCIDA feels that ANY harvest of nonlocal salmon in the KMA is a 'problem', despite the fact that Cook Inlet salmon have historically been present in the KMA and were identified in KMA salmon harvests in virtually all KMA MSA studies. Nonlocal sockeye salmon are a natural occurrence in the KMA, the magnitude of which may be related to overall abundance. Many uncontrollable factors are involved such as weather, ocean conditions, and migratory patterns.

ACR #11 - Question 4A: The fishery conservation purpose or reason appears to be that currently ADF&G does not use precise genetic stock estimates in development of escapement goals, management plans or brood tables.

ADF&G will use the best science available, and has successfully managed UCI and Kodiak sockeye stocks without precise genetic stock composition estimates. The KMA genetic MSA was just finished and published. TIME is needed to attempt to use data from the recent MSA. The new Kodiak sockeye genetic MSA was not designed or analyzed to determine appropriate limits on nonlocal, Cook Inlet sockeye harvest in KMA fisheries. Additional genetic studies, such as that conducted annually in Upper Cook Inlet, would be necessary.

ACR #11 - Question 4B: The error in regulation given by UCIDA seems to be the inaccurate or unfairly applied burden of conservation.

The Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222), in subsection 4) D), states "in the absence of a regulatory management plan that otherwise allocates or restricts harvests, and when it is necessary to restrict fisheries on salmon stocks where there are known conservation problems, the burden of conservation shall be shared among all fisheries in close proportion to each fisheries' respective use…" (emphasis added). UCI sockeye escapements are met, Cook Inlet salmon fisheries are allowed, so the conservation burden is minimal. There is not a known conservation problem; Susitna sockeye are a Stock of Yield Concern only.

KMA already shares the burden of conservation with Cook Inlet. In December 1989, the Board passed a regulatory plan for the harvest of Cook Inlet sockeye salmon in the KMA, the North Shelikof Strait Sockeye SMP, which:

- o **is located to afford the most protection for UCI sockeye as they migrate through the KMA commercial salmon fisheries (the North Shelikof);**
  o is timed to cover the estimated peak timing of nonlocal sockeye presence in the KMA (July 6-25);
- o **local Kodiak salmon forecasts and run strength indicators, with designated 2½ to 4½ day fishery closures each week; and,**
- o **only allows continued fishing in inshore waters (Shoreward Zones; offshore Seaward Zones, from the baseline to the 3 mile limit, are closed).**

This is already a very large conservation burden on KMA fishermen, for which no positive net effect on UCI stocks has ever been demonstrated. Over half of the Mainland and Afognak Districts are subject to fishery closures in July, based on the 1988 KMA harvest of nonlocal Cook Inlet salmon. Many KMA stakeholders would say that the conservation burden is currently unfairly slanted against KMA fishermen.

ACR #11 - Question 4C: The magnitude of nonlocal salmon harvests was known and was before the Board when KMA management plans were deliberated and adopted, but a new MSA has inspired a new round in the ongoing Cook Inlet-Kodiak fish fight.

This type of proposal is not new. In the past, UCIDA and UCI stakeholders have submitted many proposals for changes in management of the KMA fisheries. Very similar proposals were submitted to the BOF in the mid-1990s. With dozens of meetings and hundreds of hours of BOF discussions, committee discussions, as well as 2 years of work by a BOF ADF&G-Stakeholder Cook Inlet-Kodiak Inter-Area Work Group, it is clear to us that the BOF has been informed, has reviewed the KMA nonlocal salmon issue, and has deliberated on such restrictive management plan proposals.

ACR #11 - Question 6: UCIDA rightly admits that their ACR (#11) is allocative. We concur.

ACR #11 - Question 7: This compels the Board to consider an allocative proposal outside of the regular cycle. UCIDA claims that "Now, years later, with the aid of genetics, we know much more about the timing, location, extent and magnitude of the harvests of Cook Inlet origin salmon stocks. This ACR is the first opportunity to look at the harvest of Cook Inet stocks in the Kodiak Management area, and we consider this a very serious misstatement of fact. This is not the first look at harvests of Cook Inlet salmon in the KMA. Beginning in the 1920s, salmon researchers have studied KMA salmon stocks composition and shown that Cook Inlet salmon contribute to KMA commercial fisheries. The magnitude of nonlocal sockeye in KMA commercial fishery harvests has been previously studied extensively by ADF&G. MSA estimates were conducted and reported to the BOF and the public between 1989 and 1996, with similar results as the new genetic MSA.

The recent 2014-16 Kodiak genetic MSA has indeed added to the data available, however it gives little to NO definitive answers to migratory timing, location, extent or magnitude of nonlocal salmon passing through the Kodiak Management Area. It was a limited, short term study that looked at only some parts of June-August KMA salmon fisheries for only three years (three data points for each temporal/spatial stratum). Data was pooled into three fairly long temporal periods and six fairly large geo-spatial strata. For any temporal/spatial strata, there are only three annual data points. Three data points will show a false trend more often than a true trend. Three data points are most likely to show no trend.

The study cannot infer an absolute or precise harvest rate of nonlocal sockeye in KMA provided limited results from a limited sampling plan that was NOT intended to provide nonlocal salmon harvest rates, but rather the sockeye stock components of seleced KMA fisheries during limited time periods. UCIDA claims that the Kodiak sockeye genetic MSA is new information that should prompt the BOF to "look at the harvests of Cook Inlet sockeye stocks in the Kodiak Management Area. We strongly disagree. Again, more will be discussed regarding these point, in subsequent parts of this review.

ACR #11 - Question 9: UCIDA clearly states that there is NEW proposal, "not previously… before the board" and that it was "modeled after existing portions of both the Kodiak and Cook Inlet Alaska Administrative Code themes and regulations."

The proposed UCIDA restrictive umbrella plan form ACR #11 is not a new proposal. It is modeled after proposals from the November 1995 Kodiak Finfish BOF meeting and prior BOF meetings.

At that meeting, there were several such proposed changes to KMA fisheries. And the Board did not adopt any further restrictions. In the Summary of Actions taken at that meeting, it clearly states that "the past Board had pretty much resolved the issue in 1989 utilizing the best information available. And that information has not changed to this point. The effort and catch has increased in the disputed areas due to local management practices in other areas of Kodiak. And it is difficult to determine if this (is) a new and expanding fishery when both this area and Cook Inlet fisheries are at an all-time high. The overriding reason for apparent increase in intercept of Cook Inlet stocks seems to be directly related to the density and strength of that run." (emphasis added).

The 1995 Board of Fisheries reviewed MSA and harvest information and determined that shifts in effort levels could be fishermen movement due to closures of North Shelikof fisheries SMP, not new or expanded targeting of Cook Inlet stocks. They recognized that nonlocal salmon harvests occur in KMA fisheries and the relative level of such harvests were related to run strength. No biological concerns and no allocative concerns meant no change to Kodiak SMPs.

In both 1995 and 1988, Kodiak salmon fishermen submitted proposals to increase the harvest triggers used in the North Shelikof July 6-25 fisheries. They did so because the number of local Kodiak sockeye had increased since 1988, due to both an increase in natural production and increased enhancement of Kodiak sockeye. This would have increased the number of local

sockeye salmon available in the North Shelikof fisheries. However, because of the complexity of the situations involved, the BOF did not accept either proposal.

There were subsequent changes to the North Shelikof SMP. In 2002, the Ouzinkie Native Corporation, representing tribal commercial fishermen from Ouzinkie and Port Lions, proposed a less restrictive plan for Southwest Afognak section commercial salmon fisheries during the North Shelikof SMP mid-season time period (July 6-25). The BOF allowed KMA fishermen to continue to fish traditional seine hauls in the Southwest Afognak Section out to within ½ Mile of the baseline (a reduction of the Seaward Zone). And at a regular Kodiak Finfish meeting in January 2008, the Board accepted an amended version of the Ouzinkie proposal, reducing the Seaward Zone in the Northwest Afognak Section to allow KMA fishermen to continue to fish traditional seine hauls.

The BOF, despite multiple considerations of the KMA salmon fisheries and the North Shelikof plan, has not accepted proposals for increased restriction of KMA fisheries based on Cook Inlet sockeye salmon harvests within the KMA.

Concern is expressed in the ACR that if the proposed plan is not adopted, KMA salmon fisheries continue to incidentally harvest nonlocal Cook Inlet sockeye salmon, and then there will be detrimental biological or ecological effects. Yet there are no examples given of what detriments have been experienced in Cook Inlet due to recent KMA salmon fisheries or fishing patterns. Nor was any potential biological or ecological harm identified in the ACR #11.

Since 1989, the Board of Fisheries has addressed dozens of proposals from Cook Inlet salmon fishery stakeholders, for KMA management plans or regulatory restrictions. And very few changes have been made to the existing Cook Inlet-Kodiak allocative SMP by the BOF, and the BOF has not deemed it necessary to expand the regulatory KMA fishery restrictions by time (before or beyond 7/6-25) or location (North Shelikof vs. other major fishing areas of the KMA such as the east side or southwest sides of Kodiak Island).

UCIDA's proposal would establish a complicated plan covering an expanded time period (5 weeks, from 6/25 to 7/29) and newly expanded locations to include most of the KMA wild stock salmon fisheries. Within the identified time period and locations, there would be weekly and "seasonal" (6/25 to 7/29) commercial harvest limits for sockeye salmon.

This proposed plan would completely change the nature of KMA commercial salmon fisheries, and the opportunity for KMA salmon fishermen to harvest millions of local salmon would be uncertain or lost due to shifting of fisheries to only inner bays and terminal harvest areas.

Long-standing harvest strategy criteria by which KMA managers have operated could be more difficult to assure or complete. For example, since about 1971, the KMA general pink salmon fishery has been managed to coordinate multiple fishery openings whenever possible, (several locations over a wide area opening to the salmon fishery during the same time periods) to disperse the purse seine fleet. More restriction of fishing areas means more boats in smaller places, increasing the likelihood of conflict. And since about 1980, managers have attempted to

maximize harvest opportunities on the highest quality salmon during orderly fisheries. More restrictions and a completely new harvest management plan would reduce opportunities, and would likely lead to poorer quality salmon products (brighter, fresher salmon are found outside of bays and in early pink salmon fisheries) as well as the potential for more gear conflicts.

Managers would be forced to be ultra-conservative in order to meet the proposed new plan's expectation that fishery managers would make closure announcements if they EXPECT a limit to be reached or if the current harvest is within 15% of that limit. The weekly and seasonal sockeye harvest limits given in the UCIDA proposal are vastly lower than actual harvest in the past. For example, for the Westside Districts the proposed weekly limit is 12,500 sockeye, yet over the past ten years (2008-2017) the weekly Westside sockeye harvest during the 6/25 to 7/29 plan duration has averaged over 61,000 sockeye.

In our opinion, such widespread KMA fishery restrictions in late June through July (five weeks in the middle of the KMA salmon season) would greatly reduce ADF&G's management precision (more uncertainty means more conservative management) and increase the likelihood of 'lost' harvest opportunities, reduced quality of the pink salmon harvested and increase the likelihood that Kodiak sockeye and pink salmon escapements would exceed the appropriate levels that have been determined by ADF&G and the BOF.

And, the proposed sockeye harvest limits are substantially below the recent or historical sockeye harvests in those fisheries. The vast majority of past KMA salmon fisheries (1985-present) would have been restricted had this proposed umbrella plan been in effect. The proposed management plan's weekly and/or seasonal sockeye harvest limits would have been met, forcing restriction of major KMA fisheries to only inshore waters.

This is a long-running fish fight, and one could expect that the KMA stakeholders would follow with their own Agenda Change Requests, proposed management plan adoption or modifications, negative rhetoric, legislative inquiries or legal actions. The effects of the proposed UCIDA umbrella plan on traditional strategies and fishing opportunities would force a substantial negative response by not only the KMA salmon fishermen, but by processors, business owners, local Borough and City governments, and local legislators that would know and experience the negative ramifications to KMA mid-season salmon fisheries.

Based on our knowledge of the KMA commercial salmon fishery, it is expected that should this proposal pass as is, it would severely cripple the Kodiak commercial salmon fishery and devastate the Kodiak economy.

IS THERE AN EMERGENCY OR COMPELLING NEW INFORMATION?

We feel there is no biological or conservation-based emergency, nor compelling new information that forces the Board to consider this Allocative Proposal. Therefore, we see no reason to take this issue up out of the regular BOF fishery-review meeting cycle.

BIOLOGICAL CONCERNS are mentioned in UCIDA's ACR #11. For a salmon run, escapement and resulting production are known biological concerns that are affected by commercial salmon fisheries.

Escapement estimation for Upper Cook Inlet salmon streams is a complicated and changing process. Based on data obtained from ADF&G, it appears that sockeye salmon escapement goals are generally being met (Table 1), and there is no chronic inability to meet escapement needs.

Table 1. Upper Cook Inlet sockeye salmon escapement goal ranges and recent escapement estimates, 2010 2017. Data from ADF&G, Division of Commercial Fisheries, Anchorage, 8-22-17.

Sockeye Escapement Goal Ranges [1]								
2010			2011	2012	2013	2014	2015	2016
Kasilof River	160,000 - 340,000	267,013	245,721	374,523	489,654	439,977	470,677	239,981
Kenai River	1,000,000 -	970,662	1,300,000	1,599,217	1,581,555	1,359,893	1,520,340	1,704,767	1,383,692
Fish Creek	15,000 - 45,000	126,829	66,678	18,813	18,912	43,915	102,296	46,202
Chelatna	20,000 - 45,000	37,784	70,353	36,736	70,555	26,212	69,897	60,792
Judd	15,000 - 40,000	18,466	39,984	18,715		22,229	47,934	No Count
Larson	15,000 - 35,000	20,324		16,566	14,088		23,185	
			12,190		21,821	12,430		14,333

1. Escapement goals are those provided by ADF&G following a 2017 Board of Fisheries review.

Harvestable surpluses of UCI sockeye salmon have been consistently realized. ADF&G forecasts for 2014-2017 Cook Inlet salmon fisheries show significant surplus sockeye salmon production, over and above published escapement needs. Harvest records show that recent annual Cook Inlet sockeye salmon commercial harvests were in excess of forecast.

Actual Cook Inlet commercial, subsistence or sport harvests may vary and at times may even be lower than in the past. However, commercial fisheries were prosecuted in Lower and Upper Cook Inlet resulting in Cook Inlet commercial salmon fishery harvests of millions of sockeye salmon. Sockeye salmon production seems to be near historical highs, based on data provided by ADF&G.

A STOCK of CONCERN designation was placed on the Susitna sockeye stock in 2008. However, the Susitna sockeye stock was categorized as a YIELD concern, not a Management or a Conservation Concern. Even that designation was not without controversy, both for and against. The level of Concern for Susitna sockeye has not changed with almost 10 years of subsequent ADF&G and BOF review.

Based on the Policy for the Management of Sustainable Salmon Fisheries, "yield concern" means a concern arising from chronic inability, despite the use of specific

management needs (5 AAC 39.222(f)(42)). Based on the Sustainable Salmon Policy, there is an Action Plan for Susitna sockeye salmon as a Stock of Yield Concern, and that plan is reviewed and updated as necessary during salmon area specific BOF meetings. The Action Plan, in part, must contain goals, measurable and implementable objectives, and provisions, including fishery management actions needed to achieve rebuilding goals and objectives, as well as descriptions of new or expanding salmon fisheries.

Within the Susitna sockeye salmon Action Plan, there are NO new or expanding fisheries listed. This is especially surprising when considering the near meteoric rise in sport fishing effort and commercial sport fishing operations (guides, charter operators and lodges) across the State of Alaska in the past 20 years. The Kodiak commercial salmon fishery has not been identified as 'New and Expanding', nor have any portion of KMA salmon fisheries.

The Susitna sockeye salmon Action Plan designates that ADF&G Division of Commercial Fisheries will manage the Susitna sockeye stock using commercial fishery regulation of Upper Cook Inlet's Northern and Central Districts, only (Figure 1). There are no commercial salmon fisheries restrictions in Lower Cook Inlet (5 Districts) based on this Stock of Concern.

It seems like an over-reach to ask for severe commercial fishing restriction in the KMA, so far 'downstream', while ignoring Lower Cook Inlet. Especially since all Upper Cook Inlet stocks MUST pass through Lower Cook Inlet.

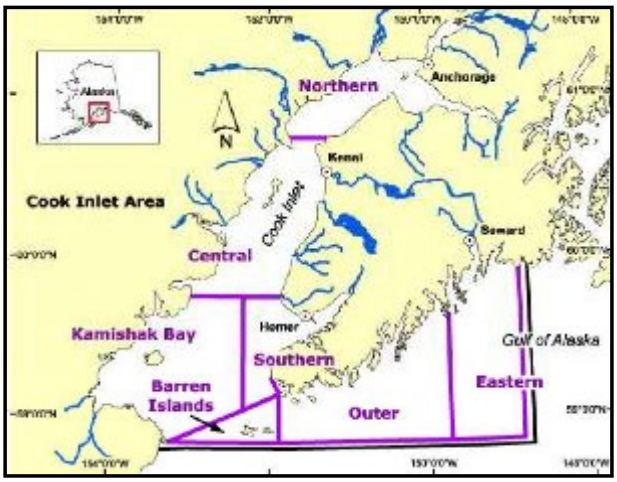


Figure 1. Map of Cook Inlet's commercial salmon fishing districts. Figure taken from ADF&G website

ADF&G has identified several other factors, besides natural or incidental mortality, that may be affecting the survival (yield) of Susitna sockeye salmon in freshwater (spawning and rearing areas), including the introduction of invasive species (Northern Pike), loss or alteration of habitat, changes in water quality or quantity, pathogens, or harvest by sport fishing. Yield Concerns, by definition, are NOT concerns for the sustainability or successful management of the stock, rather it is concern for lower than desired harvestable surpluses, above expected

escapement needs. To 'conserve' UCI sockeye salmon for harvest by a select group of Alaska fishermen, for only Cook Inlet commercial salmon fishermen or sport fishermen or commercial sport fishing business owners, is based on allocation; it is not a concern for conservation caused by new and expanding fisheries.

We feel confident that no biological reason exists for restricting KMA fisheries in order to protect Cook Inlet-bound salmon, based on the information given in the UCIDA ACR, or in the 2014-16 KMA genetic MSA (more in following part of this review).

Nothing New has been determined with which to accurately determine the impact of KMA sockeye harvests of nonlocal salmon on Cook Inlet sockeye salmon stocks.

Perhaps some people have assumed that the magnitude of the Cook Inlet sockeye component of KMA harvests was an unknown. Perhaps some people assumed that Cook Inlet salmon rarely migrate through the KMA, so the harvest numbers in the report were shocking to them.

However, the 2014-16 MSA report was not an analysis of nonlocal sockeye harvest in the KMA. It is a reporting of recent data collected in yet another MSA in the KMA. In the 2014-16 KMA sockeye genetic MSA, only very limited information from past tagging studies was included, and there is only one citation from several Kodiak MSA reports by ADF&G from 1989-1996.

Without a discussion of 'How we got here' it is often difficult to correctly ascertain exactly where we are now. It is unfortunate that, in the new MSA report, Shedd et al (2016) included only very limited information on past Kodiak sockeye MSA studies and published reports.

Earlier MSA Studies were Conducted in the KMA using existing fisheries data and samples, such as analyses of run timing, or of scale samples for stock-specific age-markers or patterns, or use of average sockeye salmon lengths or weights from KMA vs CIMA commercial harvests. A quick comparison shows that many data from the new KMA genetic MSA and from previous KMA average weight MSAs are similar. There was no mention or analysis of these facts in the new MSA report.

Included in the new MSA report are over 60 tables describing the annual estimates of local and nonlocal sockeye salmon in each of six preselected geographic areas (geospatial strata) during each of three time periods (temporal strata). The middle stratum encompasses the July 6-25 period used in earlier studies, so is most comparable with that earlier data. The 1994 Barrett and Vining report also looked at specific area harvests, some of which approximate the 2014-2016 sampling areas.

Barrett and Vining (1994), using average weights, estimated the stock compositions of KMA July harvests from eight KMA locations (geospatial strata), which are basically the same as the geospatial strata in the recent KMA genetic MSA. For example, in Barrett and Vining (1994), for Ayakulik and Halibut Bay, the nonlocal (Cook Inlet) sockeye harvests for July, 1988-1992, ranged from 103,900 to 444,400 fish. In the recent KMA genetic MSA report, the mid-season (basically July) 2014-2016 KMA harvest of nonlocal sockeye in the Ayakulik/Halibut Bay strata

ranged from 41,300 to 185,100 fish. From this comparison it is obvious that the earlier studies not only showed that Cook Inlet sockeye were present and were caught in July Ayakulik halibut Bay fisheries, but that the magnitude of the incidental harvest was greater than in 2014-2016. Should the NEW information be touted as a decline in nonlocal salmon harvests, or only annual variability?

Using another example, the 1988-1992 MSA (Barrett and Vining 1994), the July (mid-season strata) Cape Alitak nonlocal (Cook Inlet) sockeye salmon harvest was estimated at 46,400 to 63,200 fish, and in the 2014-2016 KMA genetic MSA (Shedd et al, 2016) the harvest of nonlocal sockeye in the Alitak District ranged from 37,500 to 127,700 fish. The average weight MSA estimated significant harvest of nonlocal sockeye in the Alitak District, which was confirmed by the KMA genetic MSA. However, does the new MSA study point out an increase in nonlocal salmon harvest in the Alitak Bay District, or annual variability?

There is simply no truthful way to claim that the harvest of nonlocal, Cook Inlet salmon is new information, or that the magnitude of those incidental harvests is new information, or that the timing and estimated number of incidental sockeye harvested is anything but unpredictable and widely variable between and among years.

The New Genetic MSA Report, by presenting seemingly new MSA data with high numbers and percentages of nonlocal salmon in KMA salmon harvests, without comparing that to past study data and results (such as previously determined bycatch levels of Cook Inlet sockeye in KMA harvests), has led to unfounded conclusions and has created an emotional response by stakeholders from Cook Inlet fisheries. Vital information is not included, again pointing to the need for development of a comprehensive document or set of data, for review by stakeholders and the BOF prior to deliberating on any proposed change to KMA salmon management.

In the new 2014-2016 Kodiak sockeye genetic MSA report, authors show the number of nonlocal, Cook Inlet sockeye salmon estimated to be harvested in KMA commercial fisheries as a percent of the KMA commercial harvests during selected time periods and within selected portions of the area. This shows the estimated stock contribution rate (stock proportions) of the KMA harvest. We feel this has been misleading for some people.

The Kodiak genetic MSA provides nonlocal harvest data as a percentage of the KMA harvest. It does not attempt to show the potential impact to Cook Inlet stocks. It is understandable (and should have been expected) that some people, upon seeing tables of numbers demonstrating large percentages of nonlocal salmon, may jump to the conclusion that there is a danger to the sustainability of any seemingly fully utilized stocks. The new MSA report does not provide a comparison of the estimated KMA nonlocal Cook Inlet harvest to the total Cook Inlet sockeye harvest or run, or to individual CI sockeye runs (a harvest rate).

But again, as with number of salmon, similarity between the nonlocal stock contribution proportions from earlier and recent KMA sockeye MSA is quickly evident.

Within the new MSA report, the 2014-2016 estimates of overall nonlocal contribution to KMA harvests ranged from 12% (2014) to 42% (2015 and 2016); this is within the ranges determined by earlier studies, and is not new information. In 1996, ADF&G estimated that overall, during July 6-25 sockeye salmon harvest for 1983-1995 (excluding 1989), nonlocal sockeye salmon were from 10.6% to 76.2% of the KMA harvest (excluding Cape Igvak; Vining 1996).

The average weight studies were a rigorous scientific statistical analysis, much discussed, agreed to by ADF&G headquarters, Cook Inlet and Kodiak ADF&G staffs, edited by ADF&G, and the various authors thoroughly discussed the limitations of such a study and cautioned against misapplication of results.

Comparing the estimated number of nonlocal Cook Inlet sockeye harvested in sampled KMA commercial salmon fisheries against the total Cook Inlet harvest or total run, gives a look at the harvest rate of Cook Inlet salmon in KMA fisheries. This is an important distinction, if one is trying to gauge the potential biological impact of bycatch of Cook Inlet sockeye salmon (Table 2). Still, great caution must be employed when trying to determine accurate harvest rates for Cook Inlet sockeye in KMA fisheries. We can only generate very rough estimates of harvest rates from the available data. The 2014-2016 KMA sockeye genetic MSA was not intended or designed to provide accurate harvest rates of Cook Inlet-bound sockeye in KMA fisheries.

Table 2. Estimated KMA nonlocal Cook Inlet sockeye harvest in select KMA commercial fisheries, 2014 2017. Data from ADF&G Anchorage, 8-22-17.

Year	Estimated KMA Harvest of CI Sockeye	Cook Inlet Sockeye Salmon		
		% of KMA harvest	% of Cook Inlet Harvest	% of Cook Inlet Run
2014	113,972	7.5%	4.2%	2.1%
2015	626,473	36.6%	17.9%	9.1%
2016	384,089	29.6%	12.4%	6.9%

Table 2 (above) shows that current estimated harvest percentages are also in agreement with Vining (1996); he showed the estimated percent of the UCI sockeye runs (in the Kodiak Management Area harvest) from 1983-1995 ranged from 1% to 12.1%. Using an overall estimate, it appears that less than 15% of Cook Inlet sockeye runs are harvested in KMA fisheries. It is interesting to note that the other KMA allocative plan, the Cape Igvak plan, allows KMA fishermen to harvest up to 15% of the Chignik sockeye runs. Annual variability is again perhaps the only fact that is clearly demonstrated.

The study and report document only numbers and percentages. Authors (Shedd et al, 2016a) do not comment on whether nonlocal sockeye presence and levels were an affirmation of historical migration patterns and natural background levels of historic bycatch in commercial salmon fisheries targeting Kodiak salmon stocks in this known Mixed Stock fishery.

LIMITATIONS OF THE KMA GENETIC MSA

The recent MSA study was only the first look at a KMA mixed stock fishery using modern stock separation methods (Genetic Stock Identification). And, the report clearly informs readers that it only provided new harvest statistics for some fisheries for a limited set of years, for limited time periods. The lack of analyses or any further interpretation of this data and the lack of comparisons with previous sockeye stock composition estimates, within the KMA genetic MSA report or in a separate report, has led some people to draw their own conclusions.

CAUTIONS: However, the authors (Shedd et al, 2016a) did specify that, since the study was limited, caution must be exercised when trying to extrapolate limited results to wider questions or if trying to fit the data to other issues: "However, while this 3-year data set provides some measure of interannual variability in environmental and fishery conditions, some caution must be exercised when extrapolating the results to years, areas, and temporal periods not analyzed because changes in relative abundance among reporting groups, prosecution of fisheries, or migratory behavior due to ocean conditions very likely affect distribution of stock-specific harvests among fisheries." (Shedd, et al, 2016a, page ; emphasis added).

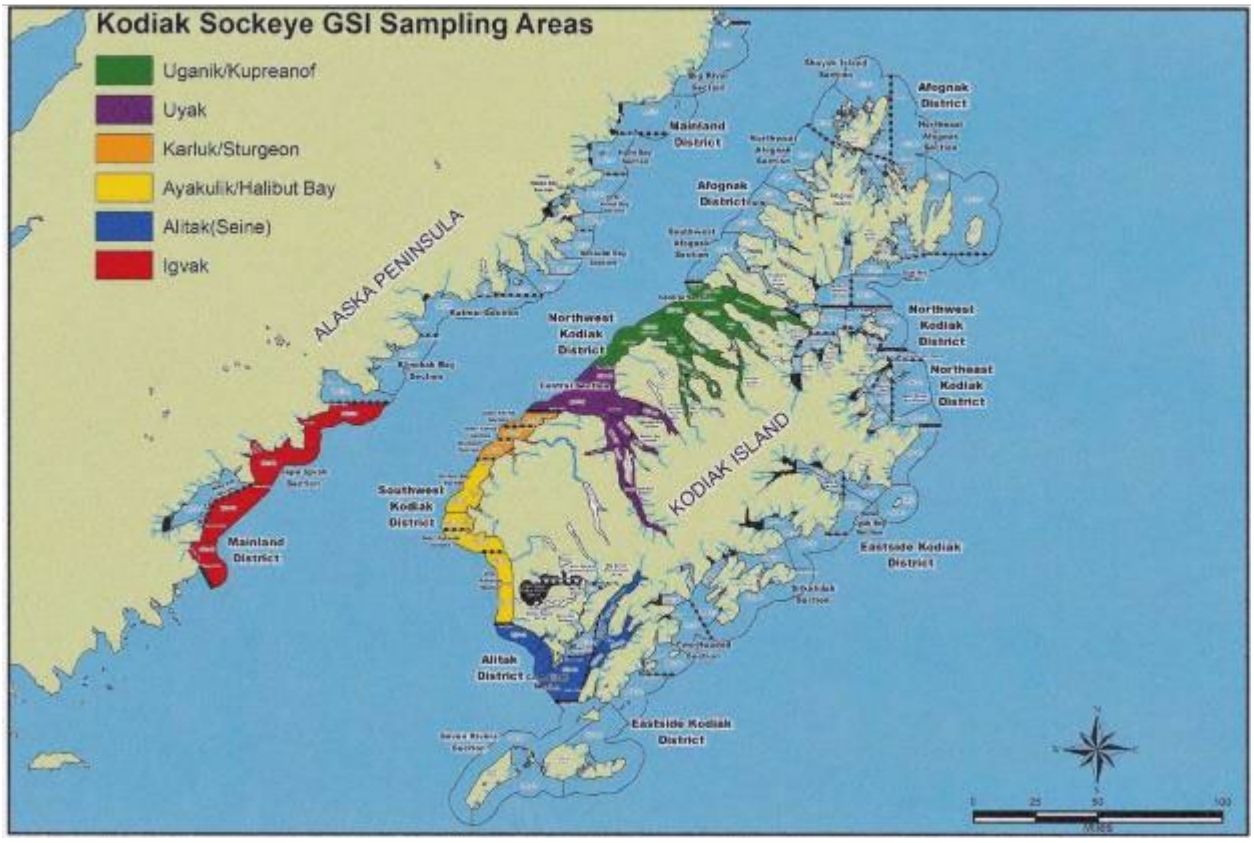


Figure 2. Kodiak Area management units sampled for genetic stock identification, 2014-2016.
Figure taken from Shedd, et al, 2016.

Funding Limits are very real constraints. Authors of the 2014-16 MSA report also found that

"funding constraints limited the scope of this project to specific sampling areas and time periods". The genetic sockeye MSA study planners had to limit both the study area (number of geospatial strata) and the time periods (temporal strata within the June 1 to October 31 KMA commercial salmon fishing season). Though the initial objective of this project was to sample the major directed sockeye salmon commercial fisheries in marine waters of KMA, only eight locations were selected, with all of them in the west and southwestern part of the KMA (Figure 2. **Only three sampling time periods were used, spanning June 1 through August. Significant harvests of sockeye salmon can occur in September and October.**

Other Limits: It is clear that the new MSA study is a "snapshot", showing results of samples collected from limited areas during limited time periods over a limited set of years. Not included in this new MSA study were not only the known areas where KMA fisheries may target nonlocal stocks (Afognak and Mainland District sections bordering the North Shelikof), but also areas of prior Board review for KMA harvest of nonlocal sockeye (Eastside Kodiak District). The authors of the new MSA report admit that, succumbing to funding limits, they sampled less than they intended, both in areas covered and time periods sampled.

The authors admit that GSI techniques are not robust enough to distinguish between Ayakulik and Frazer sockeye stocks; they did not attempt to distinguish between local Saltery stock sockeye salmon (Eastside District) and enhancement project production at Spiridon Lake (NW Kodiak District; west side). Are there other stocks that are difficult to distinguish? ADF&G also published a KMA Genetic Baseline report that contains many such statistics and graphic presentations. However, it is not clear to me, and may not be to any but the initiated, if there are KMA and UCI sockeye stocks that are so closely 'related' genetically, that there could be overlap or misidentification (i.e. Horse Marine sockeye salmon).

The study does not speculate on reasons for the observed variability in harvests between the three years. There are factors that could influence this and research could be directed at answering other important questions beside 'How many?' Funding has limited sampling by time and area, and stock similarity has limited the separation of at least three stocks, so this study cannot reveal the full picture over a robust set of years.

Do the results clarify or obfuscate issues relating to the use of this data or the controversy regarding KMA harvest of nonlocal sockeye?

The new KMA genetic MSA report authors believe that the study was successful: "These results represent a majority of sockeye salmon commercial harvests in KMA and should improve our understanding of stock productivity and migratory patterns, and provide information to evaluate assumptions built into management plans." (Shedd, et al, 2016a, page 23; emphasis added).

Sufficient time should be given for ADF&G managers and researchers to utilize the limited data they've collected to discover its usefulness to actual fishery management needs.

We note that the 2014-2016 MSA report may seem incomprehensibly technical to some, but it s easy to seize on numbers! As written, this report is of questionable utility for BOF members for the purpose of a specific discussion of issues that could lead to restrictive regulatory changes to

KMA salmon fishery management, let alone stakeholder understanding, interpretation, and education. We do not mean to diminish the work done; the report is a fine piece of Scientific Reporting, and meets ADF&G standards for technical publications.

The 2014-16 MSA report is fine for a scientific audience, not as the basis for stakeholder discussions or restrictive BOF actions that would destabilize the KMA fisheries. For concerned stakeholders, and the BOF, it is more likely to lead to misunderstanding, and raises more questions than answered. People want to jump on numbers, but may miss the limitations.

We feel this technical study and report should only serve to provide limited information on a limited study. It should be the impetus and basis for a further report to BOF, if the BOF determines that further review is needed at this time.

The study results alone are not sufficient for restricting KMA fisheries to potentially re-allocate sockeye salmon harvests; an additional more comprehensive report on the specific issue of Cook Inlet salmon within the KMA should be considered to educate and inform stakeholders and begin discussions, prior to Board action.

Any such additional document would need to include a thorough discussion of issues (not stats, not methods, etc.) in more digestible form. A more colloquial summarization, perhaps formulated by a joint stakeholder committee, would best serve <u>if</u> further discussion of nonlocal salmon harvest in the KMA is to become a Board of Fisheries agenda item at 'Special' meetings or the next regular Kodiak Finfish meeting.

The intent, goals and objectives of the new MSA study and report are shown within the report. Caution must be taken against misuse the data provided based on personal concerns.

It was not the intent and goal of the new MSA to produce specific information for a BOF review of KMA fisheries, nor was it to suggest restriction of the KMA fishery due to reported UCI sockeye harvest numbers. And the new MSA study and report's goal was certainly not to open another allocative dispute, though that outcome could have been predicted and may have been prevented by additional analyses.

<u>INTENT</u>: When reviewing a scientific study, it is vital to bear in the forefront of one's mind the general intent or purpose of that study, its specific goals and objectives, as well as the assumptions and limitations that encompass any analyses. It may be difficult, even dangerous, to try to draw answers or conclusions from information that was not collected specifically to answer that question, or which has many poorly founded assumptions. The possibility for misinterpretation, misuse and mistakes are increased. False assumptions or misinterpretation of data can lead to completely inaccurate conclusions.

The KMA sockeye genetic MSA study (or indeed any study) and the report should primarily be viewed through the lenses of the intent, or purpose, of the study. What was the intent of study planners and report authors? What was it needed for and why? What did it seek to show or do?

What issues or what answers were beyond the scope of the study? Attention to intent, goals and objectives will inform us what the results may actually demonstrate.

Unfortunately, the intent of the new MSA study is not clearly defined in the early portions of the report, but rather is found scattered throughout the report. In the acknowledgements comes the most basic purpose of this study. Authors thank a former ADF&G Director for "prioritizing department resources to address this knowledge gap in KMA" (Shedd, et al, 2016a, page 27; emphasis added).

Genetic stock identification for Mixed Stock Analysis has been completed for much of Western Alaska (WASSIP), and GSI has been used in Cook Inlet since 2005, to identify the mixed stocks within UCI fisheries. No such genetic data existed for the KMA (a knowledge gap), so a Kodiak salmon genetic MSA was funded.

PLEASE NOTE: the MSA of Cook Inlet fisheries show NO nonlocal salmon, not because only local stocks are present... it appears that nonlocal stocks are NOT part of the UCI MSA model. That is, researchers assume that there are NO nonlocal salmon in Cook Inlet fisheries; nonlocal sockeye are not looked for! You can't find what you don't look for.

In other places in the new MSA report we find additional comments regarding intent. The authors state that: "The impetus for this study was to provide analytically sound estimates of stocks harvested in KMA fisheries to better understand stock productivity and address management assumptions. The principal objective of this project was to sample the major directed sockeye salmon commercial fisheries in marine waters of KMA." (Shedd, et al, 2016a, page 23).

Unfortunately , what the authors meant by "management assumptions" is not defined within this report; if that was a serious consideration by study developers and planners, then those assumptions should have been clearly defined. All assumptions of specific scientific research, particularly if they are to be tested in the study, should be clearly stated. The need to address management assumptions, if not defined, should not be a focus for use of data collected.

As former Kodiak Area Management Biologists, we know of no 'management assumptions' that would require a three year genetic study. Indeed, as managers we know that limited research is too often misused and is commonly taken 'too far' by strongly opinionated people in attempts to prove their point.

In another passage the authors state that: "While nonlocal harvest of sockeye salmon in KMA commercial fisheries has been assumed in regulation and demonstrated in previous studies based on tagging, scale pattern analysis (Barrett and Swanton 1991, 1992), or average weight (Vining 1996), this project represents the first effort to use modern MSA techniques to quantify that harvest" (Shedd, et al, 2016a, page 26; emphasis added).

The primary intent was to use newly provided funding for a 'first effort' to try genetic stock identification methods in a Kodiak MSA, since no GSI had been attempted prior to 2014.

STUDY GOAL or PRINCIPLE OBJECTIVES: The report authors specifically define their goal: "The overall goal of this project is to provide information that will be useful for reconstructing runs, building accurate brood tables to define escapement goals, and refining management by identifying spatial and temporal harvest patterns of local and nonlocal stocks…." (Shedd, et al, 2016a, page 5, emphasis added).

Unfortunately, this goal has NOT yet been met. Satisfactory completion of the stated goal will require additional time and analysis of the gathered information.

It is important to give ADF&G time to actually apply these results to run reconstructions and brood table development. ADF&G may then be able to refine pre-season management by providing better predictors of stock productivity and anticipated run strengths (forecast). Inseason fishery management will not be improved.

It truly seems that there is an intent to reverse the order and to change management based on a limited study, rather than explore the statistics to see if solid, scientifically valid results point to needed changes in established, stable management. The possibility exists for future analysis and study, additional research, discussions between stakeholders and managers, researchers, and the BOF. We encourage the BOF to take this opportunity, and to use this study as intended. We fear a hasty, knee-jerk reaction to an emotional issue to appease a vocal user group.

The principle objective has been addressed, yet not fully met. "The principal objective of this project was to sample the major sockeye salmon commercial fisheries in marine waters of KMA from June through the end of August and use genetic mixed stock analysis (MSA) to estimate stock compositions. The study only partially accomplished this objective. KMA harvest samples have been collected and analyzed using the most current genetic MSA techniques. However, the project was not able to sample all KMA commercial fisheries, and so was limited to specific geographic areas, within specific time strata, for a limited number of years.

ADF&G study planners and authors agreed, with authors stating that: "these results may only have limited utility in formal run-reconstructions for 2 primary reasons. First, not all fishing areas were sampled, and sampling did not include harvest after August 29, when substantial numbers of Karluk and Upper Station late-run fish can be harvested. Second, the genetic baseline was unable to adequately distinguish between Ayakulik and Frazer stocks for the purposes of MSA." (Shedd, et al, 2016a, page 26).

To meet the study's goals, it would appear that there is a need to work further with the information gathered, in run reconstruction (back-casting, to improve fit of forecasting models) and escapement goal review. Authors caution: "Management would benefit from estimates of stock-specific harvest of Ayakulik and Frazer stocks and future research should explore means to accomplish this objective (Shedd, et al, 2016a, page 24).

There needs to be further analysis of the Ayakulik/Frazer samples to either separate or determine and apply additional information needed to split this grouping into the two distinct stocks.

Four (4) objectives are then specifically listed, 1 through 4, yet these objectives address the report, not the study. The stated objectives for the report that describes the study are:

1) Describe sampling of genetic tissues from sockeye salmon caught from June through August in select commercial fisheries in the KMA, 2014 2016;
2) Describe subsampling of genetic tissues in proportion to catch within sampling areas and temporal strata;
3) Report MSA results of stock proportions and stock-specific harvests of sockeye salmon sampled from select commercial fisheries in the KMA, 2014 2016;
4) Characterize where stocks were harvested from select commercial fisheries in the KMA, Shedd, et al, 2016a, page 5)

AN IMPERFECT DESIGN

The new MSA study design left many pertinent questions unanswered and many data needs unmet. The study design seems practical for the general overall goal; that is, during some portion of KMA commercial salmon fishery, to collect samples from some portion of the KMA salmon fisheries and analyze for genetic MSA stock identification, over three years.

Unfortunately, it was not designed to address or answer some very fundamental questions that could enlighten the issue of variable incidental harvest of Cook Inlet sockeye in KMA fisheries. As shown previously, the study did not include the North Shelikof Straits. However, it is possible that, with additional sampling, analyses or interpretation of results, more definitive answers or conclusions could be made that would be helpful to the BOF during their consideration of this ongoing fish fight.

The BOF has attempted to 'solve' this issue in the past. After 4 years of ACRs and proposals at every Kodiak Finfish BOF review, in 1994 the BOF formed a Work Group to determine possible solutions.

In 1994, a Kodiak / Cook Inlet Inter-Area Work Group (hereafter referred to as the IAWG or the Work Group) was formed by the BOF. As previously stated, in 1988 following the occurrence of a large harvest of nonlocal sockeye salmon in mid-stream Shelikof Strait, the active allocative dispute between Cook Inlet and Kodiak fishermen gained strength. From 1988 through 1996, Kodiak ADF&G conducted sockeye stock identification studies (MSA). Cook Inlet-Kodiak allocative conflicts were the subject of many meetings with the Board of Fisheries. The IAWG met several times prior to reporting to the BOF at a Special Meeting in March 1995.

At the beginning of IAWG discussions, ADF&G researchers and managers, Work Group stakeholder members, and the BOF members mutually agreed upon several key 'facts':

- The bycatch of Cook Inlet-bound sockeye in KMA fisheries is directly proportional to Cook Inlet sockeye run strength;
- The incidence of Cook Inlet sockeye in KMA fisheries varies widely. It is inconsistent as to area, annual timing, and between years;
- The incidence of Cook Inlet salmon in KMA fisheries is 'insignificant' if the Cook Inlet sockeye run is less than 4 million;
- The July 6-25 period is not only an important time period in KMA salmon fisheries management, it is the period of PEAK abundance of Cook Inlet-bound sockeye salmon in KMA waters;
- Within that period, the majority of bycatch occurs within a narrower, 7-10 day period.

These facts were established by ADF&G and stakeholders on the IAWG, based on the 19881995 Kodiak MSA studies and fisheries. These facts served the BOF and ADF&G by focusing the scope of research and discussions to a manageable level and by focusing any potential Board action on the most effective time period within the fishing season.

The 1994-95 Inter-Area Work Group also recommended that ADF&G undertake additional inseason stock-separation studies and develop inseason indices or markers to determine when Cook Inlet salmon are present in KMA fisheries. The IAWG asked that Kodiak and Cook Inlet ADF&G estimate timing and percentage of Cook Inlet run present.

Other serious limits to the Kodiak sockeye genetic MSA include:

GEAR SELECTIVITY could have biased many of the genetic MSA samples. The geospatial strata included 2 location in the Central Section (Uyak and Uganik/Kupreanof), where both Set Gillnet and Seine gear are legal to operate. Based on concerns for getting 'pure' samples from these specific locations, the samples were collected from fixed set gillnet gear. Gillnets will select for the larger fish. In both 2015 and 2016, average sockeye sizes were lower than average, which would further bias against the smaller, local Kodiak sockeye. Karluk sockeye are the dominant stock, so these locations represent the major sockeye fishery of the KMA. Yet, the MSA study does not even mention gear type in the discussion of genetic sampling.

TEMPORAL STRATA used in the 2014-16 KMA genetic MSA do not readily correspond with actual KMA management plan fishing periods, which includes an important mid-season management period (July 6-25). We also feel the time periods used for this study are not sufficiently narrow to define periods when Cook Inlet sockeye stocks may be in the KMA and vulnerable to harvest.

Temporal strata were not consistent among the three years of the study, and the use of different and changing mid-season temporal strata effectively muddles the comparative usefulness of the data presented. During 2014 and 2016 the middle strata dates were June 28 through July 25, and in 2015 this was shifted to July 4 through August 1. While we recognize that, in some years, run timing may be delayed, pushing the mid-season temporal stratum by 7 days based on someone's perception of run timing also confounds interpretation of the study results and their potential use for regulatory discussions. The KMA regulatory Salmon Management Plans all use calendar DATES that do not shift based on perceived run timing.

Anecdotal, first-hand knowledge shows that the location of harvest of larger, suspected Cook Inlet sockeye are almost ephemeral… here today, gone tomorrow. More relevant to CIMA-KMA allocative issues might be the selection and achievement of specific numbers of genetic samples during narrower time periods that correspond to how KMA fisheries are actually prosecuted, particularly during the July 6-25 time period.

GEOSPATIAL STRATA employed in the KMA genetic MSA report are overly broad, and the ability to determine potential offshore or cape fishery "hot spots" was lost. This could lead to misrepresentation. For example, Alitak sampling did not include set gillnet areas and combined the inside (inner bay) and outside (cape or offshore) seine fisheries; it was meant to be representative of the entire Alitak District harvests. However, even limited information about more specific harvest location is of interest and could be important in understanding stock compositions, timing and migratory patterns in KMA mixed stock fisheries.

DATA POOLING may also obscure important or essential information. The manner in which samples were later subsampled and data was pooled to fit temporal strata affects how the sample data can be used. Within the 2014-16 KMA genetic MSA report, there is no commercial fishery data given beside sample date, sample and subsample size, and the reported KMA sockeye catch from that particular sample was from a Seiner or Gillnetter. Effort data is lost.

Caution must be taken in use of the KMA genetic MSA data. Again, we feel that since the study was limited by its intent and goals, by funding, by MSA and study design shortcomings, and was not designed to answer the known and important questions regarding Cook Inlet sockeye in KMA salmon harvests, such as above, then it would be very unwise to apply this new data other than as intended.

DOES THE GENETIC MSA CREATE MORE UNCERTAINTY OR LESS?

The 2014-16 MSA report provides good presence/absence data, and provides MSA composition estimates for some geographic strata and/or time periods previously either unsampled or found to have insignificant or undiscernible levels of nonlocal sockeye. The report simply presents data, with little interpretation, leaving that to the readers. However, to fully explain the harvest numbers, there are many additional considerations (which we hope are becoming clearer after our review).

Presenting snapshots of fishery harvest stock compositions does not elucidate why or how those levels of harvest may have occurred. Is it due to targeting, or some unusual environmental factors? The 2014-16 MSA report does not show actual fishing time during periods in question… Was commercial fishing effort in high catch stratum due to targeting? Did participation increase following some initial 'event'? Would the effects of actual 2014 to 2016 management actions (Emergency Order-based fishing time) and commercial fishing effort point to a 'problem area'?

It should be fairly easy to disprove beliefs that there is a targeted interception fishery on Upper Cook Inlet sockeye in KMA fisheries. Yes, salmon fishermen target sockeye salmon, due to market demand and price, but KMA fishery managers and fishermen are not conducting a secret fishery within KMA salmon fisheries. A pairing of sample collection and estimated stock composition data with actual hours of fishing time and number of landings would show the incidental nature of nonlocal sockeye harvests.

The current KMA salmon commercial fishery management 'harvest strategy' relies on a period during July (July 6-25) when fishing periods targeting pink salmon are weekly 'pulse fisheries' with limited hours of fishing time allowed each week. Pink salmon numbers increase almost exponentially during this time period, but fish QUALITY remains good. After July 25, management sections may be opened for longer weekly periods only in sections where production is expected to be in excess of escapement needs. Management during the July 6-25 mid-season time period actually reduces potential bycatch of nonlocal sockeye. We feel that is an important consideration.

Similarly, without consideration of all factors, some may believe that KMA salmon stocks could all be harvested within 'terminal' fishing areas or 'inside the capes'. Long experience has shown that allowing salmon to enter the fresher (less saline), warmer, inside-waters of the KMA will very quickly lead to loss of quality, or to complete loss to the fishery as the fish home-in and refuse to move out of closed water sanctuaries.

Without consideration of all factors, we cannot answer truly important questions (i.e. Why is there such variability in estimated nonlocal contribution to KMA salmon harvests, between and among years, time strata and geospatial strata?) This could be a topic requiring much study to fully elucidate.

The depth and complexity of the issues involved requires extensive analyses and discussions between ADF&G authors and managers and interested stakeholders, just to set the ground rules for further review and evaluation of proposed restrictive BOF actions. We feel this cannot occur in a few months, but will require additional time for all parties to become apprised of important considerations which may not be apparent to someone not intimately familiar with both KMA and Cook Inlet fisheries and the issues at hand.

We feel that there has always been some level of nonlocal sockeye salmon harvests in KMA salmon fisheries; KMA is a mixed stock fishery. This is an annual part of the KMA salmon fishery harvest, not an aberration or an unanticipated consequence or a new and expanding targeted 'interception' fishery. Identifying the 'natural' background level of harvest of nonlocal salmon would allow for the identification of new or expanding fisheries on nonlocal sockeye salmon versus historical fisheries of the KMA.

If 'reallocation' of some portion of the KMA salmon fishery harvest is to occur (restricting KMA fisheries with the HOPE to positively influence the harvest in UCI) then a lot of information needs to be clearly elucidated in a comprehensive report to the BOF. We offer a limited list of questions that we would like to see addressed prior to any BOF action.

EVALUATION OF APPLICATION OF THE POLICIES OF THE ALASKA BOF

MIXED STOCK FISHERIES POLICY

In March 1993, the Alaska Board of Fisheries (BOF) adopted a significant policy into regulation, The Policy for the Management of Mixed Stock Salmon Fisheries (5 AAC 39.220; effective 5-291993). The Mixed Stock Fisheries (MSF) policy created a framework through which the BOF could analyze specific Alaska salmon fisheries with the goal of determining if Board action is appropriate and required to conserve and protect the salmon stocks in question. With this policy in regulation, any proposed change in the salmon fishery regulations or Board approved Management Plans, is to be judged against the criteria established in the Mixed Stock policy.

In fact, the 1988-1992 allocative disputes between the sport and commercial fishermen of Cook Inlet and the commercial salmon fishermen of the KMA were the 'backdrop' during the discussion and adoption of the Mixed Stock Policy into regulation.

The first use (test) of the MSF Policy following its adoption by the BOF (March 1993) was yet another petition from Upper Cook Inlet stakeholders seeking to control the harvest of Cook Inletbound salmon in KMA salmon fisheries; that petition failed.

It is important to evaluate each of the MSF policy's elements, and those of the associated findings (93-07-FB), against the best available information regarding the Kodiak salmon fishery, the associated take of Cook Inlet sockeye, and the status of Cook Inlet's sockeye stocks.

Pertinent sections of the MSF policy and our evaluation include:

(a) In applying this statewide mixed stock salmon policy for all users, conservation of salmon stocks consistent with sustained yield shall be accorded the highest priority"

wild

For UCI sockeye salmon, conservation and sustained yield, the highest priorities under the Mixed Stock Policy, are not threatened. This leaves allocation as the major consideration left, and any BOF actions must abide by established allocation criteria.

(b) In the absence of a regulatory management plan that otherwise allocates or restricts harvests and when it is necessary to restrict fisheries on stocks where there are known conservation problems, the burden of conservation shall be their respective harvest on the stock of concern"

shared among all fisheries in close proportion to

.

There is an allocative management plan in place that allocates and restricts harvest, the North Shelikof fisheries management plan.

Further, no conservation problem has been shown for Cook Inlet sockeye stocks (Susitna Sockeye are a Stock of Yield Concern, not Conservation Concern). KMA commercial salmon fishermen currently bear a burden of conservation which protects an unknown proportion of nonlocal salmon within KMA waters and fisheries. Would additional restrictions actually help

in possible future conservation concerns? We feel the BOF should not be restricting fisheries

and reallocating historic harvests of nonlocal salmon in the absence of a true Conservation Concern. We feel that much additional discussion is needed to begin to define and answer such questions.

(d) Consequently, the board will restrict new or expanding mixed stock fisheries… Natural fluctuations in the abundance of stocks harvested in a fishery shall not be the single factor that identifies a fishery as new or expanding.

The KMA harvest of nonlocal salmon is neither new nor has it been shown to be expanding. In fact, the number of participants in KMA fisheries has significantly contracted (Figure 3). The KMA salmon fishery is old and contracting!

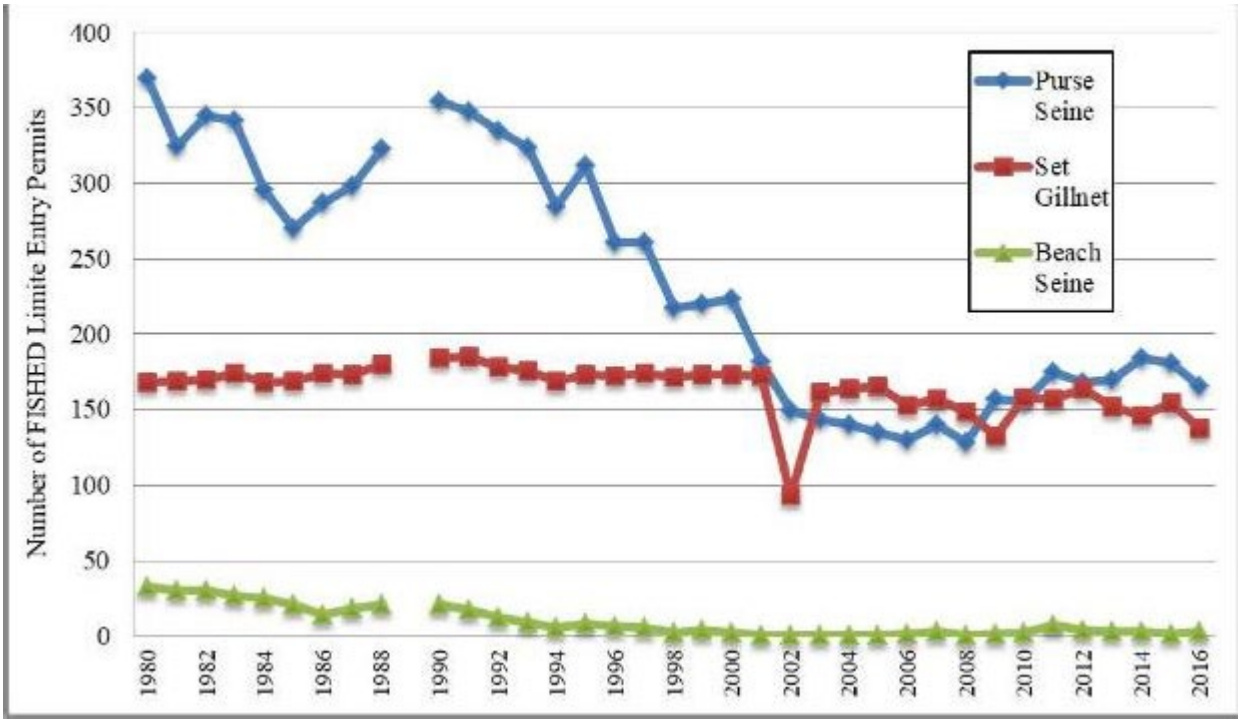


Figure 3. The number of Limited Entry permits actually fished for Kodiak commercial salmon fisheries, by gear type, 1980-2016. (No 1989 fisheries due to EVOS) Data from ADF&G, Kodiak.

For the 2014-2016 MSA study period, KMA set gillnet permit participation was down 22.5%, KMA purse seine participation was down 52.6%, and KMA beach seine participation was down 92.4% from the number of available permits to fish during those same three years.

A determination of the "natural fluctuation of abundance" of nonlocal salmon in the KMA is required in order to define any "new and expanding" fisheries in the KMA that target nonlocal sockeye salmon.

(e) This policy will be implemented only by the board through regulations adopted (1) during its regular meeting cycle, or (2) through procedures established in the …Policy for Changing Board Agenda (5 AAC 39.999).

This issue must be tabled until KMA fisheries come up in the regular BOF meeting cycle. The criteria for changing the BOF agenda have not been met.

Past analyses of the harvest of Cook Inlet sockeye in Kodiak waters, using the accepted MSA at the time, have postulated that such bycatch is negligible when Cook Inlet returns are poor to average (Ruggerone and Rogers, 1994). Under conditions when conservation of Cook Inlet's sockeye returns would be a concern, it is not likely that any significant Kodiak bycatch of those sockeye would occur. You can't catch what isn't there.

The Board's Findings, associated with adoption of the Mixed Stock Fishery policy regulations, not only reiterate specific points of the policy but amplify and clarify the Board's intent outside of the constraint of regulatory language. Several of these findings apply to consideration of this Kodiak-Cook Inlet sockeye issue.

The Board found that Alaska's salmon industry appropriately relies upon stable existing fisheries, most of which harvest mixed stocks. Kodiak's established management program for the harvest and conservation of mixed stocks has been successful in sustaining and promoting Kodiak's century-old industry. The findings also speak to harvest of many mixed stocks with an eye towards QUALITY of the harvest, and management of KMA fisheries has promoted protection, rebuilding and high-quality harvests of a large number of stocks of salmon. To restrict fisheries to inside 'terminal' areas will lead to a significant decline in salmon quality, thereby significantly reducing the volume and value of KMA salmon fisheries.

KMA salmon fisheries are already managed according to a well-orchestrated series of management plans, none of which need to be amended now to account for harvests of fish that fluctuate on the basis of natural abundance and pose no threat to conservation. There is no indication that 135 years of commercial salmon fishing in Kodiak's waters ever posed any threat to Cook Inlet salmon stocks

SUSTAINABLE SALMON POLICY: The Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222; aka Sustainable Salmon policy), developed by the BOF, was adopted into regulation in September 2000. This policy greatly expands some of the same principles found in the Mixed Stock policy.

The policy updates and strengthens long-standing principles of Alaska's salmon management program. Most importantly, it directs ADF&G and the Alaska Board of Fisheries to follow a systematic process for evaluating the health of salmon stocks throughout the state by requiring ADF&G to provide the Board, in concert with its regulatory cycle, with reports on the status of salmon stocks and fisheries under consideration for regulatory changes (Clark, et al, 2006). The policy also defines a new process for identifying stocks of concern (stocks which have not met escapement goals or yield expectations), and requires ADF&G and the Alaska Board of

Fisheries to develop action plans to rebuild these stocks through the use of management measures, improved research, and restoring and protecting habitat.

The Sustainable salmon policy is a long and very complicated policy, and we will not attempt to review KMA nonlocal salmon harvests through all of its many parts. We will instead point out what we consider to be salient points that apply to the current issue.

The stated goal of the policy include not only conservation of salmon and habitat, and protection of subsistence and other customary and traditional uses plans, restricting fisheries to protect nonlocal salmon, would negatively change the economic health of Kodiak communities to a considerable degree.

The policy also provides many clear definitions for terms commonly used and newly developed terms or classifications. Of note is the definition of Stocks of Concern (SOC). As mentioned earlier, the Susitna sockeye salmon stock was listed as a Stock of Yield Concern in 2008. Yield chronic inability, despite the use of specific management measures, to maintain expected yields, or harvestable surpluses, above a stock's escapement needs; a yield concern is less severe than a management concern, which is less severe than a conservation concern". Based on that definition, there is NO conservation concern for Susitna sockeye salmon.

The policy dictates that an Action Plan be developed for SOC action. Such plans "should contain goals, measurable and implementable objectives, and provisions" including "fishery management actions needed to achieve rebuilding goals and objectives, in proportion to each fishery's use of, and hazards posed to, a salmon stock" and "a research plan as necessary to provide information to address concerns".

The Action Plan for Susitna sockeye salmon, as prepared by ADF&G and approved by BOF through at least three BOF meeting cycles (over 9 years), contains NO mention of concern about Susitna salmon harvest in adjacent Areas (Kodiak) nor the need to further investigate (through research) possible nonlocal harvest. There is no concern of sufficient importance to even consider nonlocal harvest, let alone restriction of KMA salmon fisheries.

In fact, restriction to address the SOC status of Susitna sockeye salmon are limited to Northern or Central District salmon fisheries. No ADF&G management actions are taken in Cook Inlet salmon fisheries in the more southerly districts of the Cook Inlet Area (including Kamishak, Southern, Eastern and Outer Districts). The VAST majority of Susitna salmon MUST migrate through those southerly districts.

How could a restriction to KMA salmon fisheries, where some unknown portion of the Susitna sockeye run may sometimes migrate in unknown patterns) even be considered?

Deferral of ACRs and potential BOF regulatory action until the regular meeting cycle for KMA (and UCI) salmon fisheries is supported by our analysis of application of other BOF policies and criteria. This issue should be addressed within the BOF regular schedule for consideration of Alaska salmon fisheries, during the 2019/2020 cycle.

CONCLUSIONS

Importantly, not included in the new 2014-16 MSA report is any discussion of the incidence of KMA sockeye salmon in Cook Inlet or Chignik salmon fisheries. We learn in elementary school that we should first balance an equation in order to solve it, and working with unequal factors will lead to skewed solutions. The KMA is nestled between the Cook Inlet and Chignik management areas. Early tagging studies sought information on stock of origin as well as migration patterns and timing.

Management plans defining fishing opportunities on KMA local stock were developed by stakeholders, Management Biologists at ADF&G, concerned representatives of government and scientific agencies, and many prior Alaska Boards of Fisheries, over the course of many years. Discussions and decisions were made with full knowledge that KMA was a mixed stock fishery and that significant numbers of both Chignik and Cook Inlet sockeye will be found and may be harvested in KMA fisheries.

Nowhere in existing Alaska Statute, regulation, policy, or management plan does it allow for decisions based on political expediency or personal bias. Allocative pressures within Cook Inlet salmon fisheries are very real, very large, and are growing. The establishment of BOF findings is needed, clarifying the extent to which Inter-Area allocative disputes may be used to modify long standing regulatory structure. Without a definitive pronouncement that x number or percent of nonlocal salmon are harvested, either generally or by stock of origin, then allocative fish fights will be waged.

It is impossible to maintain the economic success of a fishery that is subject to capricious reduction based on poor information or colloquial opinion. A Board finding that historic KMA harvest may contain x% of salmon from Cook Inlet and x% of Chignik salmon will allow determination of new or expanded fisheries and sound allocative decisions.

The 2014-2016 MSA report is a technical report and maximum opportunity needs to be given for this report, and all other pertinent data, to be interpreted for stakeholders and interested parties. It's written in a format that makes ready understanding difficult for those uninitiated in modern genetics research. The format of the report does not lead to easy consumption. It's long on methods, techniques, statistics and data (a data dump from a three year project) and short on analysis.

All parties would benefit from time spent discussing the report, finding answers to questions that it brings up, seeking information from ADF&G or others, educating and discussing pertinent issues with as many stakeholders as possible, defining problems (from the most obvious to the minute), defining possible and favored BOF actions, refining arguments (both for and against), and educating the public. All this should occur PRIOR to full BOF review and deliberation on potential regulatory actions. Another document, more comprehensive and written for BOF and Stakeholder consideration, would be helpful and should be drafted with clearly defined issues and goals, all available data, lists of possible actions and repercussions, as well as the potential of success of proposed actions under the defined goals.

This issue, while not new, is unique and very complex. The new 2014-16 MSA only represents another piece of the larger puzzle. Representative and informed decision will require different /more information and involves further discussions with and between ADF&G and stakeholders. Stakeholders need background and education. They need to narrow their concerns, look for common ground, identify issues and potential problems, review possible actions to deal with the identified issues, and then suggest to the BOF a range of possible actions and recommendations, if needed.

There is potential for additional analyses or even additional research studies that would better inform the issue. We urge caution, and with no immediate biological conservations issues we urge the BOF to postpone or deny any regulatory limitations to the KMA salmon fisheries at this time.

It is a broad truth that Mother Nature has allocated nonlocal salmon to Kodiak salmon fisheries. It cannot be predicted, nor can it be identified inseason or postseason, without a recurring annual MSA. The effects of restricting KMA fisheries to limit nonlocal sockeye harvests on CIMA sockeye escapement or harvest cannot be identified or quantified.

REFERENCES CITED:

Anderson, T .J., J. Jackson, and B. A. Fuerst. 2016. Kodiak Management Area commercial salmon fishery annual management report, 2016. Alaska Department of Fish and Game, Fishery Management Report No. 16-42, Anchorage.

Anderson, T. J., and J. Jackson. 2017. Kodiak management area harvest strategy for the 2017 commercial salmon fishery. Alaska Department of Fish and Game, Fishery Management Report No. 17-20, Anchorage.

Barrett, B.M. 1989. North Shelikof Strait 1988 catch distribution, timing and stock contribution. Alaska Department of Fish and Game, Regional Information Report No. 4K88-6, Kodiak.

Barrett, B.M., and C.O. Swanton. 1991. Origins of sockeye salmon in the Kodiak Management Area North Shelikof Strait Fishery, 6 July 6 through 25 July, 1990. Alaska Department of Fish and Game, Regional Information Report No. 4K91-3, Kodiak.

Barrett, B.M., and C.O. Swanton. 1992. Estimation of the major sockeye salmon stocks contributing to the North Shelikof Strait Fishery of July 6-25, 1988-1992. Alaska Department of Fish and Game, Regional Information Report No. 4K92-43, Kodiak.

Burbank, D.C. 1977. Circulation studies in Kachemak Bay and lower Cook Inlet. Vol. III of Environmental Studies of Kachemak Bay and lower Cook Inlet, ed. by L.L. Trasky, et al. Marine Coastal Habitat Management Report, Alaska Department of Fish and Game, Anchorage, AK.

Clark, J.H., A. McGregor, R.D. Mecum, P, Krasnowski, and A.M. Carroll. 2006. The Commercial Salmon Fisheries in Alaska. Alaska Department of Fish and Game, Alaska Fishery Research Bulletin 12(1): 1-146

French, R.R., Bilton, H., Osako, M., and Hartt, A. 1976. Distribution and origin of sockeye salmon (Oncorhynchus nerka) in offshore waters of the North Pacific Ocean. International North Pacific Fisheries Commission Bulletin 34: 1 113.

Gard, Richard, and Richard Lee Bottorff. 2014. A History of Sockeye Salmon Research, Karluk River System, Alaska, 1880 2010. U.S. Dept. of Commer. NOAA Technical Memorandum NMFS-F/SPO-125, 413 p.

Muench, R.D., and J.D. Schumacher. 1980 . Physical oceanographic and meteorological conditions in the Northwest Gulf of Alaska. NOAA Technical Memorandum ERL PMEL-22. Seattle; Pacific Marine Environmental laboratory. National Oceanic and Atmospheric Administration.

Ruggerone, G. T., and D.E. Rogers. 1994. Harvest rates of Upper Cook Inlet-bound sockeye salmon commercial salmon fishery. Natural Resources Consultants report to the Kodiak Island Borough Salmon Working Group. Seattle.

Shedd, K. R., M. B. Foster, T. H. Dann, H. A. Hoyt, M. L. Wattum, and C. Habicht. 2016a. Genetic stock composition of the commercial harvest of sockeye salmon in Kodiak management area, 2014 2016.
Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-10, Anchorage.

Shedd, K. R., T. H. Dann, H. A. Hoyt, M. B. Foster, and C. Habicht. 2016b. Genetic baseline of North American sockeye salmon for mixed stock analyses of Kodiak Management Area commercial fisheries, 2014 2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-03, Anchorage.

Shedd, K. R., M. B. Foster, M. Wattum, T. Polum, M. Witteveen, M. Stratton, T. H. Dann, H. A. Hoyt, and C. Habicht. 2016c. Genetic stock composition of the commercial and sport harvest of Chinook salmon in Westward Region, 2014 - 2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-11, Anchorage.

Tarbox, K.E., 1988. Migrator rate and behavior of salmon in Upper Cook Inlet, 1983-1984. Alaska Department of Fish and Game, Fishery Research Bulletin 88-05, Juneau.

Thompson, W.F. 1950. Some salmon research problems in Alaska. A talk prepared for the Meeting held by the National Research Council, on scientific research in Alaska, Alaska Science Conference, Nov. 9 11, 1950, Washington, DC. University of Washington Fisheries Research Institute, Circ. No. 11, 20 p.

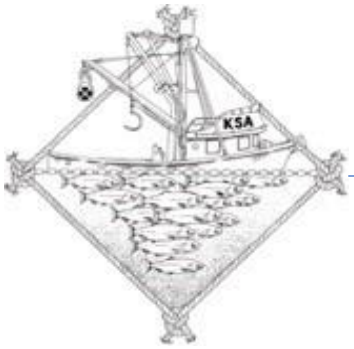
Thompson, W. F., and D. E. Bevan. 1955. A proposal for experimental regulation of the Karluk fishery. University of Washington Fisheries Research Institute, Circ. No. 72 revised, Kodiak Island Memo. No. 13
(November 16, 1954, revised October 12, 1955), 10 p.

Van Cleve, R. and D.E. Bevan. 1973. Evaluation of causes for the decline of the Karluk sockeye salmon runs and recommendations for rehabilitation. Fish. Bull. 71(3): 627 649, 661 663.

Vining, I. W. and B. M. Barrett. 1994. The use of average weight to estimate the amount of interception of non-local sockeye salmon within selected areas of the Kodiak management area. Alaska Department of Fish and Game Regional Information Report 4K94-05, Kodiak.

Vining, I. W. and B. M. Barrett. 1995. The use of average weight to estimate the level of harvest of nonlocal sockeye salmon within the Kodiak management area, during July 6 25, 1983 1994. Alaska Department of Fish and Game Regional Information Report 4K95-11, Kodiak.

Vining, I. W. 1996. The use of average weight to estimate the level of harvest of non-local sockeye salmon within the Kodiak management area, during July 6 25, 1983 1995. Alaska Department of Fish and Game Regional Information Report 4K96-28, Kodiak.



Kodiak Seiners Association
PO Box 8835
Kodiak, AK 99615

December 24, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: **Opposition to Proposal 63**

Dear Chairman Morisky and Board of Fish Members:

The Kodiak Seiners Association (KSA) is writing to express our **opposition to proposal 63** which creates "seaward" and "shoreward" harvest zones in the mainland district of the Kodiak Management Area (KMA) with the intention of preserving king salmon bound for Cook Inlet waters. KSA recognizes the scarcity of King Salmon in the Western Gulf of Alaska, and we understand that these circumstances call for extreme management measures in order to preserve stocks with critically low populations. With this in mind, we endorse and encourage the continuation of the non-retention policy for king salmon in Kodiak waters. This policy has now been in place for 6 seasons and amounts to an extraordinary and unusual conservation practice that our fleet has willingly accepted.

Proposal 63 relies on fundamentally flawed assumptions about the harvest of king salmon in Kodiak. There is no evidence to suggest that king salmon are harvested in greater abundance in the Seaward Zones, and in fact, feeding kings typically accumulate further into bays where they prey on herring, capelin, and other schools of baitfish. These salmon, colloquially termed "feeders" have particularly high mortality rates when released due to scale loss. Feeders comprise the majority of king salmon harvested in Kodiak, and adoption of proposal 63 would likely intensify the harvest and mortality of king salmon in the KMA. Forcing the seine fleet into "shoreward zones" is therefore a counterproductive approach to conserving king populations and it entirely lacks a sound scientific basis.

The Board should also be aware that the area under consideration for proposal 63 is already the most restrictively managed seine area in the KMA. There are no general openers allowed in the mainland district in June, and in July a maximum of 4 non-extendable 57-hour openers are allowed. It is not unusual for the Cape Igvak section to remained entirely closed before July 25th, and the Wide Bay section cannot open before July 27th, despite prolific pink and chum runs in the area. Under the current management plan our members already consider fishing opportunities in the mainland district to be insufficient, particularly on years of abundant early pink and chum salmon returns, when high

harvest rates and escapements still don't allow for extensions of fishing time during July. The Board should consider the conservation burden inherent in imposing weekly 111-hour closures in this area.

KSA strongly believes that conservation measures are most effective in the vicinity of the natal streams of concerned stocks. This fact become most apparent when analyzing the content of Cook Inlet bound king salmon as a component of the overall harvest in the KMA. Kodiak harvested 7,723 kings last year out of a total harvest of 36,251,506 salmon. The genetic stock assessment of chinook in the KMA determined an average harvest rate of 3.6% Cook Inlet origin stocks. This means that only one out of every 130,388 fish harvested in the KMA is the intended conservation target of this proposal 63.

There is absolutely no factual basis to believe that the areas covered by this proposal exhibit consistently high harvest rates of Cook Inlet chinook stocks, and given that the catch of chinook is typically random and evenly diffused throughout harvest in the KMA, the Board can expect that every chinook preserved by this plan will result in the unintended harvest loss of at least tens of thousands of salmon of various species from healthy stocks. Unless there are absolutely no other management measures that can be taken in the vicinity of the runs of concern, it would be entirely unjustifiable to enact a management plan that has such immense and certain costs without conveying any measurable benefits.

KSA also believes that Board policy must be applied consistently throughout the state. If the current Board wishes to engage in such a drastic policy shift that it would begin adopting additional measures to further limit the harvest of non-local stocks in Kodiak then we would expect and anticipate these standards to apply to regions to our south, such as the Chignik Management area, where there are currently *no* measures in place designed to limit the harvest of non-local stocks. The Kodiak seine fleet has had to bear the sole burden of conservation for our local stocks in addition to the conservation burden of non-local harvest inherent in the Cape Igvak and North Shelikof Straight management plans. Salmon management in the Western Gulf of Alaska already exhibits an inequitable distribution of the burden of conservation due to the uneven applications of Board policies. Kodiak fishermen have been resultantly held accountable for non-local harvest while our own stocks are apparently considered unworthy of similar concerns when harvested in other management areas.

KSA acknowledges the current scarcity of king salmon in the western gulf, and we accept that commercial fishermen have an important role to play in the conservation of these fish, however it is our hope that the BOF understands and openly acknowledges that the current state of scarcity of GOA chinook was not caused by longstanding commercial fisheries and that unusually high and accounted ocean mortality rates are driving the population decline.

Without knowledge of what is causing the scarcity of king salmon, but with an understanding that minimal volume of Cook Inlet origin king salmon is caught in the KMA, it is important that the public temper its expectations of conservation potential within the Kodiak area. Although some individuals may express resentment of the harvest of any kings in Kodiak, it is important that conservation measures are designed to be effective instead of merely punitive. You cannot use management measures in the KMA to conserve fish that Kodiak fishermen simply aren't catching.

KSA respectfully requests the Board **reject proposal 63.** We thank you for the opportunity to comment on behalf of the membership of KSA. We appreciate the scientific and factual creation of regulations regarding our fisheries and trust that the Board continue to apply consistency in designing regulation changes while applying the guiding BOF policies, such as the Management for Mixed Stock Salmon Fisheries.

Kodiak Seiners Association represents 157 members, including the majority of actively fishing SO1K seine permit holders, Kodiak and Homer-based businesses, and individual crewmembers. Our focus is advocacy for our membership through positive interactions with ADF&G, the Board of Fisheries, and our State Legislature.

Sincerely,

Nate Rose
KSA President

December 24, 2019

Matthew Alward

60082 Clarice Way

Homer, AK 99603

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: Opposition to proposal 63

Dear Chairman Morisky and board of fisheries members,

I live in Homer, AK and run my own seine boat in the Kodiak salmon fishery and I oppose proposal 63 that would create a prescriptive management plan through July 28th in the mainland district. I raised our family on the back deck of our fishing boat and the mainland district has been an integral part of our fishery. To create time and area management based on no scientific data would only cause large economic harm to Kodiak with no known gains.

This proposal seeks to create "seaward" and "shoreward" zones in the mainland district with only two 12 hour openings allowed in the seaward zone per week with the intention of making Kodiak share in the burden of conservation of Cook Inlet origin king salmon stocks. According to the Alaska Department of Fish and Game's (AKDFG) Fishery Manuscript series No. 16-11 Genetic Stock Composition of the Commercial and Sport Harvest of Chinook Salmon in Westward Region, 2014-2016 tables 35, 36, and 37 there was an average of 21 Cook Inlet origin Chinook salmon harvested annually in the mainland district. There is no data or research that looks at king salmon harvest in the mainland district based on the seaward and shoreward zones and thus there in no data to base prescriptive time and area management on to create a sharing of the burden of conservation of Cook Inlet king salmon stocks.

When asked "what is the issue you would like the board to address and why" the proposer states that since Kodiak seine fishermen are required to release king salmon 28 inches and over there is not enough data to quantify King salmon harvests and stock origins in the mainland district. While I do agree that the required release of king salmon 28" and over creates a lack of data, I would also argue that that

same lack of data is justification enough for not creating time and area closures for the purpose of King salmon conservation.

In closing I want to reiterate that the genetic data that we do have about king salmon harvests in the mainland district states that there is an average annual harvest of 21 Cook Inlet origin king salmon with no data if those fish are caught in the proposed “seaward” or “shoreward” zones. Given the genetic harvest data that we do have and the lack of data to justify the prescriptive management proposed I respectively ask that you oppose proposal 63 and do not adopt it.

Sincerely,

Matthew Alward

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

Michelle Rittenhouse PO Box KWP Kodiak, AK 99697 December 18, 2019 Chairman Reed Morisky Alaska Board of Fisheries Board Support Section PO Box 115526 Juneau, AK 99811-5526 RE: Proposal #65 Dear Chairman Reed Morisky and Board of Fish Members: I am a 3rd generation commercial fisherman from Kodiak, AK. I have been an active participant in Kodiak’s salmon fishery for 23 of my 32 years, working alongside my family as crew until I purchased my own vessel, which I have been operating since 2013. As a young business owner heavily invested in especially the Kodiak salmon fishery, and whose livelihood is solely based on fishing, I consider this proposal a serious threat to my ability at making a living. I respectfully ask that the Board reject proposal #65. The Kodiak management plan has a longstanding history for being tried and true. It has been well-constructed to prevent conservation issues to other fishing areas and salmon stocks of non-local origin. It is a known fact that salmon runs are cyclical in nature, experiencing highs and lows in returns, and to blame Kodiak fishermen for the lack of salmon returns to other areas is a baseless argument with negligible evidence to support it. My reliance on getting as much fishing time as possible during the salmon season in Kodiak continues to grow heavier, as other options I explore, such as longlining for halibut and Pacific gray cod fisheries continue to diminish in stock. It is difficult enough to survive the normal ups and downs our fisheries, much less make changes to Kodiak’s management plan that will forever negatively impact my ability to pay off my fishing operation. Commercial fishing is not only my livelihood, but also my passion, and I would like to continue doing it for many years to come. Again, I respectfully request that the Board of Fish reject Proposal #65. Thank you for giving me the opportunity to comment, and for your time. I hope the Board continues to apply consistency in its application of the guiding policies such as the Mixed Stock Fisheries Policy and the Sustainable Fisheries Policy. Most sincerely, Michelle Rittenhouse

Mike ferris
F/V Cally Rose
12/20/2019 10:07 AM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

I am a life long kodiak resident & salmon Seiner, I'll keep it short but if its not broke don't fix it the existing management plan that has been in place since late 80s is effective and proven to be adequate

Nicholas Hoffman
PO Box 1212
Kodiak, AK 99615

12/24/19

Chairman Reed Moriskey
Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: Oppose Proposal 63

Dear Chairman Morisky and Board of Fish members:

I'm a young Kodiak salmon fisherman. I have been running a seine boat since 2011 as well as participating in Kodiak halibut, sea cumber, cod jig, and tanner crab fisheries. I respectfully request the Board reject Proposal 63.

This proposal would severely limit Kodiak fishermen from harvesting our local stocks of pink, chum, and sockeye salmon. The Chinook Salmon non-retention has dramatically reduced the number of king salmon caught by the Kodiak seine fleet. This proposal puts an unfair weight of conservation on the commercial seine fleet when the current sport catch of Chinook salmon is equal to the seine catch with few limits and little reporting. In addition, the sport catch of Chinook salmon has been expanding in recent years with new charter boats arriving every year.

I see no reason for the Board to make any changes to the Kodiak Salmon Management plan. Thank you for the opportunity to comment on the proposals and the chance for my voice to be heard. I look forward to the Board of Fish members getting to spend time in Kodiak and learn more about our town and fishing community.

I humbly request the Board reject Proposal 63.

Sincerely,

Nicholas Hoffman
F/V Relentless

Oliver Holm
self
12/27/2019 03:12 PM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

I have over fifty years experience fishing salmon around Kodiak, mostly seining. The connection to Cook Inlet chinook is faulty because the vast majority of chinook caught around Kodiak are not of Cook Inlet origin. This is known from coded wire tagging and genetic sampling. Another thing wrong with this proposal is the idea that more kings are caught while fishing off shore. In deeper offshore waters kings have the ability to dive out of our relatively shallow seines. Where they can't dive out is in shallow water inshore. We don't target kings and we shouldn't be penalized for the glut of hatchery released kings feeding in the Kodiak area some years.

December 24, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 63

Dear Chairman Morisky and Board of Fisheries Members,

I am Richard Roth, Kodiak salmon purse seine permit holder. Thank you for the opportunity to comment on proposals for the Kodiak finfish meeting. My wife three children and I reside in Homer, but fish in Kodiak. I own and operate the F/V Sea Tzar. We rely solely on salmon seining for our livelihood and annual income to support our business, our family and contribute to our Alaskan economy through business and personal expenditures.

According to the 2014-2016 study of Genetic Stock Identification of Chinook Salmon in the sport and commercial fisheries in Kodiak, 80% of the kings caught in both sport and commercial fishery are from British Colombia and U.S. West coast. In 2014 the total Kodiak Management Area commercial harvest of Cook Inlet origin kings was **182 fish**, in 2015 total Cook Inlet origin kings was **334 fish**, and in 2016 total Cook inlet origin kings was **260 fish**. The economic loss of amending the Kodiak Management Plan per the proposer's recommendations could never be balanced by the economic gain to the Cook Inlet region of another approximately 180-334 individual kings total.

In 2016 McDowell prepared a report on the economic impact of the seafood industry in the Kodiak region for the Kodiak Island Borough (KIB) and the City of Kodiak. They found that for every million pounds of salmon landed and processed in the KIB, $900,000 in total labor income is created in the KIB economy, including all direct, indirect, and induced effects. For every million dollars paid to fishermen for salmon landed in the KIB, a total of $1.22 million in labor income is created in the KIB. This doesn't even include fishermen, like me, where our income contributes directly to the economy of the Kenai Peninsula.

This proposal is short-sighted and borders on absurd in its aim to claim a small handful of kings at the expense of a much larger fishery which contributes to the food security of our nation.

I request that the Board to reject this proposal.

Richard, Amanda, Stephanioe, Noah, and Ranger Roth
F/V Sea Tzar
Homer, Alaska

December 19, 2019

Robert Fellows

266 E Bayview Ave.

Homer, AK. 99603

Alaska Board of Fisheries

Board Support Section

PO Box 115526

Juneau, Ak. 99811-5526

RE: Opposition to proposal 63

Dear Chairman Morisky and Board of Fisheries Members,

I am a commercial fisherman who has fished salmon in the Kodiak management area for 29 years. My family and my crew and their families depend on the commercial salmon fishery in Kodiak for the majority of our yearly income. This proposal would make it extremely difficult to make a living commercially fishing salmon in The Kodiak management area. I respectfully request the Board reject proposal #63.

The chinook salmon genetic stock identification information from 2014-2016 shows that 80% of the sport and commercially harvested kings are from British Columbia and US West Coast origins. The total commercial harvest of Cook Inlet origin kings in the Kodiak Management Area for 2014 was only 182. For 2015 it was 334, and for 2016 a total of 260. The economic loss to the Kodiak commercial salmon fishery that would happen under this proposal could never be balanced by any type of gain in the Cook Inlet region by so few fish. In addition, the Cook Inlet year around sport/charter fishery extracts far more Cook Inlet bound kings. I have attended Homer area AC meetings where this proposer, who is on the Homer AC, makes a habit of putting forth misleading information.

Sincerely,

Robert Fellows

Ron Kavanaugh
self
12/28/2019 12:54 AM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

We are opposed to this proposal. We believe it would cause local mangement problems, that it is purely an attempt to reallocate without care for local Kodiak stocks or King Salmon.

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

December 24, 2019 Alaska Board of Fisheries Board Support Section P.O. Box 115526 Juneau, AK 99811-5526 Re: Opposition to Proposal 63 Dear Chairman Morisky and Board of Fisheries Members, I am Steve Roth, Kodiak and Lower Cook Inlet salmon purse seine permit holder. Thank you for the opportunity to comment on proposals for the Kodiak finfish meeting. My wife and I reside in Homer, but fish in Kodiak. I own and operate the F/V Sea Grace. We rely solely on salmon seining for our livelihood and annual income to support our business, our family and contribute to our Alaskan economy through business and personal expenditures. ? According to the 2014-2016 study of Genetic Stock Identification of Chinook Salmon in the sport and commercial fisheries in Kodiak, 80% of the kings caught in both sport and commercial fishery are from British Colombia and U.S. West coast. In 2014 the total Kodiak Management Area commercial harvest of Cook Inlet origin kings was 182 fish, in 2015 total Cook Inlet origin kings was 334 fish, and in 2016 total Cook inlet origin kings was 260 fish. The economic loss of amending the Kodiak Management Plan per the proposer’s recommendations could never be balanced by the economic gain to the Cook Inlet region of another approximately 180-334 individual kings total. In 2016 McDowell prepared a report on the economic impact of the seafood industry in the Kodiak region for the Kodiak Island Borough (KIB) and the City of Kodiak. They found that for every million pounds of salmon landed and processed in the KIB, $900,000 in total labor income is created in the KIB economy, including all direct, indirect, and induced effects. For every million dollars paid to fishermen for salmon landed in the KIB, a total of $1.22 million in labor income is created in the KIB. This doesn’t even include fishermen, like me, where our income contributes directly to the economy of the Kenai Peninsula. This proposal is short-sighted and borders on absurd in its aim to claim a small handful of kings at the expense of a much larger fishery which contributes to the food security of our nation. I request that the Board to reject this proposal. Steve and Jenny Roth F/V Sea Grace Homer, Alaska

Corina Watt, Kodiak Salmon Setnet Commercial Fisherman
Trap Pt/ Moser Bay Fisheries: Alitak District with sites across Olga, Moser & Alitak Bays
12/25/2019 09:01 PM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

I support proposal 63 to “Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25” for the following reasons: 1) It will increase the quality and viability of many local Kodiak sockeye salmon systems. 2) It will support a return to higher escapements for local sockeye systems including early and late Upper Station runs and Dog Salmon in the Alitak District of Kodiak. 3) It will support long term sustainability Kodiak sockeye salmon systems.

Ed Fisher, Kodiak Salmon Setnet Commercial Fisherman
Trap Pt/ Moser Bay Fisheries
12/25/2019 10:28 PM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

I support proposal 63 to “Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25” for the following reasons: 1) It will increase the quality and viability of many local Kodiak sockeye salmon systems. 2) It will support a return to higher escapements for local sockeye systems including early and late Upper Station runs and Dog Salmon in the Alitak District of Kodiak. 3) It will support long term sustainability Kodiak sockeye salmon systems.

Jason Watt Kodiak Salmon Setnet Fisherman
Trap Pt/ Moser Bay Fisheries, Alitak District with sites across Olga, Moser & Alitak Bays
12/25/2019 09:03 PM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

I support proposal 63 to “Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25” for the following reasons: 1) It will increase the quality and viability of many local Kodiak sockeye salmon systems. 2) It will support a return to higher escapements for local sockeye systems including early and late Upper Station runs and Dog Salmon in the Alitak District of Kodiak. 3) It will support long term sustainability Kodiak sockeye salmon systems.

Judy Fisher, Kodiak Setnet Commercial Salmon Fisherman
Trap Pt/ Moser Bay Fisheries
12/25/2019 10:32 PM AKST

RE: PROPOSAL 63 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25 based on those zones

I support proposal 63 to “Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 1–July 25” for the following reasons: 1) It will increase the quality and viability of many local Kodiak sockeye salmon systems. 2) It will support a return to higher escapements for local sockeye systems including early and late Upper Station runs and Dog Salmon in the Alitak District of Kodiak. 3) It will support long term sustainability Kodiak sockeye salmon systems.

Aaren Ellsworth

12/28/2019 12:44 AM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

I oppose this proposal. The mixed stock nature of KMA salmon fisheries and the KMA harvest of nonlocal Cook Inlet sockeye salmon are well known, not new. Targeting of nonlocal salmon has been minimized by focusing fishing opportunity only on the abundance of local salmon. KMA commercial salmon fishermen already bear a disproportionate Conservation Burden for Cook Inlet sockeye stocks through the regulations for the North Shelikof Strait Sockeye Salmon Management Plan.

Aaron Nevin

12/27/2019 09:16 PM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

The cape igvak section is already managed in an overly conservative way. Its the most restricted area on the island. It seems wrong to restrict it further and limit our local stocks for an insignificant amount of other areas fish. My name is Aaron Nevin. Being born in Kodiak to a commercial fisherman father I grew up fishing salmon on his seiner. I have continued on in my currently twenty year long career to buy a permit and run his boat after retirement. The seining season usually accounts for the majority of my annual income and is incredibly important to my family.

Adam Barker
Kashvik LLC
12/27/2019 12:11 AM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

Adam Barker 41584 Manson Dr Homer, AK 99603 December 26th 2019 Chairman Reed Morisky Alaska Board of Fisheries-Board Support Section P.O. Box 115526 Juneau, AK 99811-5526 RE: Prop # 64 Dear Chariman Morisky and Board of Fish members: My name is Adam Barker, I have been fishing in Kodiak since 1988 as a third generation fisherman. I started with my dad and now I'm an owner operator of my own vessel since 1999. I now take my two children out fishing. I respectfully request the board reject proposal # 64. I roundly oppose this prop as an attempt to remedy the poor gillnet salmon fishing in Cook Inlet. Stopping Kodiak seiners from fishing the capes as they have for the last 40 years will not improve commercial salmon gillnetting in Cook Inlet. In fact the Kenai river was over-escaped last year. A unfortunate problem that cannot be blamed or fixed by constraining the "Kodiak Management Area." Please reject this proposal as an attempt to bind and control the Kodiak Seine fleet in an attempt to bolster the ailing Cook Inlet gillnet fishery. Thank you for the chance to comment. I hope the board continues to apply consistency in its application of the guiding policies such as the mixed stock fisheries policy, and the sustainable fisheries policy. Sincerely, Adam Barker

Adelia Myrick
P.O. Box 2971
Kodiak, AK 99615

December 26, 2019

Alaska Board of Fisheries
Boards Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Dear Board of Fish members:

I am writing in opposition to proposal 64 for many reasons. There is no new data (despite the proposers arguments that the Shedd genetic report is new information) and if the proposal were to be adopted, it would set a difficult and dangerous precedent about mixed stock management statewide, it would severely damage ADF&G's ability to manage all of Kodiak's salmon species for sustainability, and it would impose drastic economic hardship to Kodiak's salmon fishermen.

I am a second-generation Kodiak fisherman. My father started salmon fishing here in 1967, and I have setnetted since I was a toddler with my family, for my whole life. I took over the permit from my dad several years ago, and in 2016 finally bought the setnet operation from my parents outright. It was a monumental business decision allowing me to quit teaching at the college (where I had benefits and retirement), but one that I made with the historic nature and rhythms of the fishery in mind. Knowing that there are always bound to be cycles of horrible years mixed in with good ones, I determined that, through careful financial management and planning, I could make it work – setnetting in Kodiak could provide for me. As a young fisherman entering the industry, I am in a particularly precarious financial position. If this proposal were to go into effect, it would change everything. Having five weeks of severely curtailed fishing time for the seine fleet would increase pressure in the already crowded central section of the Northwest Kodiak district, which is the only area where setnetters can fish. We can't fish elsewhere and are already feeling the squeeze. If there are more seiners pushed into the bays, we will all struggle economically.

My opposition to the agenda change request is not only about my circumstances, or me, however. The change request simply doesn't make any sense. I know you consider and deliberate about what precedents you set, and this proposal is concerning for several reasons.

A. There is no new conservation concern. Kodiak salmon fisheries have proceeded historically in the same manner for decades. There is no new fishery or targeted catch of Cook Inlet bound sockeye, so the conservation

concern should not be considered new. There are no new fishing patterns. In terms of sustainability, according to the "Sustainable Salmon Fisheries Policy Checklist" of 2008, there is nothing happening in Kodiak that causes a concern about sustainability. I argue that the Kenai peninsula is where habitat degradation is occurring, not Kodiak, particularly not the west side of the island, which is virtually all National Wildlife Refuge land, and on the pristine Mainland. Kodiak should not bear the conservation burden for the peninsula's habitat destruction.

B. The Kodiak and Cook Inlet management plans have been developed carefully with input from many stakeholders over the years, and this one genetic study of only 3 years, while perhaps interesting does NOT indicate that there has been an error in regulation. In fact, it simply confirms what we already know.

C. While at first glance, the genetic stock composition study does seem to shed new light on the mixed stock nature of Kodiak's salmon fishery, analysis into historical information and records shows this is not the case. This study clearly does not represent any new information that wasn't present when the Kodiak and Cook Inlet management plans were established, nor is it even enough information to establish any trends. Independent third party reviews of the study indicates that finding mixed stock in KMA is not surprising given the historical information on file. According to the third party report, "Barrett and Swanton (1991) report that sockeye harvests in the North Shelikof Strait in the 1940s, 1970s and 1980s ranged from 30% to 100% Kodiak fish and 0% to 59% Cook Inlet origin fish." This historical information is supported, not contradicted, by the latest science. In addition, as any scientist will tell you, a small-scale 3-year study is not enough to understand a pattern or trend. Kodiak's managers had the information available when developing our current management plans, and there is no reason to believe that this information was unforeseen when the plans were developed.

It is also important to consider the implications of this proposal in a broader sense. Of grave concern is the precedent that this would set regarding mixed stock management, statewide. We have never believed that Kodiak catches only Kodiak fish, due to its location. This was taken into account when developing management plans. What's key here is that Kodiak is not unique. Your 1993 finding, "Alaska Board of Fisheries Findings on Policy For Mixed Stock Salmon Fisheries" (93-145-FB), provides guidance. Particularly relevant are the following points:

(2) "…Most mixed stock fisheries are long standing and have been scrutinized many times by past boards. Consequently, existing regulatory management plans are understood to incorporate conservation burden and allocation…."

(3) "The policy should recognize that salmon resources are generally fully utilized and that stability is an important aspect of the fishery."

(5) "The policy should not be a tool to be used for allocating outside of the Board's allocation criteria."

Sustainability of all salmon stocks is, of course, in the best interest of everyone in the state of Alaska. However, this proposal hamstrings Kodiak's salmon managers, taking away the tools they need to effectively manage a complex, multi-species salmon fishery. Although I am a new site owner, I have been fishing my whole life and have been steeped in the history of Kodiak's salmon fishery. I know that Kodiak's management plans have been developed carefully to manage the complex nature of our fishery; they are not just about sockeye. The plans also take into account chum, coho, and pink salmon. If our fishing time is to be curtailed, how will that affect the health and sustainability of ALL of our species? What will stop over-escapement? In the Northwest Kodiak District, we have seen first-hand the effects of over escapement at Karluk, which caused a huge crash of the system and basically created "disaster fishing" for sockeyes from (2008 to 2012) for many of us. Supporters of this proposal will argue that we can fish the inner bays. This is not a solution for several reasons. Setnetting is not allowed in the inner bays, so only part of the users of Kodiak would be able to access those fish; the fish are of lower quality and that is the last thing we want to put on the market; and most alarmingly, weather and other events of nature and run timing can more easily allow over-escapement to occur. We must allow Kodiak's fisheries managers the tools to manage the different KMA areas for long-term sustainability, and this proposal basically erases those tools by mandating closures not based on science but on arbitrarily chosen numbers.

The proposal would have severe economic repercussions, as well. Kodiak has been managed in the same manner for decades, and has a whole economy built on the stability of the commercial salmon fishery. This proposal ignores the other species we rely on in Kodiak – pinks are my bread and butter – and would significantly hurt my bottom line. It isn't just a matter of a few fishermen's livelihoods being torn apart, though – it's a matter of the whole community struggling to stay afloat. Losing those tax dollars would have a significant negative effect on Kodiak's overall health as a community.

Quite simply, we have a new genetic study with more detailed and up to date scientific analysis and methods, but the information it contains regarding the mixed stock nature of Kodiak's fisheries is NOT new and WAS taken into account when the management plans were set up. I'm old enough to remember my parents writing letters to the BOF regarding the Kodiak/Cook Inlet conflicts and discussions that took place in the early 90's over the exact same issue, and I know it has all been hashed out before. If anything, we need more science, not knee-jerk reactions.

Thank you for your work and deliberation on this important issue.

Sincerely,

Adelia B. Myrick
Uganik Bay Setnetter

December 24, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 64

Dear Chairman Morisky and Board of Fisheries Members,

I am Alex Roth, Kodiak and Lower Cook Inlet salmon purse seine permit holder. Thank you for the opportunity to comment on proposals for the Kodiak finfish meeting. My wife and I reside in Homer, but fish in Kodiak. I own and operate the F/V Wandering Star. We rely solely on salmon seining for our livelihood and annual income to support our business, our family and contribute to our Alaskan economy through business and personal expenditures.

The author of this proposal is citing a genetic study showing nothing new, simply a confirmation of something already known – that Cook Inlet origin sockeye sometimes swim through Kodiak waters. There are measures already in place (such as the North Shelikof Management Plan) that address this, to ensure that the vast majority of Cook Inlet- bound sockeye that do swim the Shelikof, make it through. Placing a cape to cape line on the mainland would keep Kodiak-area managers from maintaining the stability of local pink, silver, and chum salmon and raise serious concerns and precedents about the underlying foundation of common property fisheries in the State of Alaska.

Instead of an attempt to restructure the fisheries in a neighboring region, the Board's time would be better spent investigating the number of years the Kenai and Kasilof rivers have exceeded their escapement, and yet Cook Inlet drift-gillnetters and set-gillnetters still have minimal fishing time when in other regions there would be emergency openings to maintain the health of fish stocks and the rivers. For example, 2019 was a banner year, and yet commercial fishermen were forced to sit on their hands while the Kenai and Kasilof rivers were over-escaped by the hundreds of thousands.

The Kodiak Management Plan is a solid plan that has a proven working track record. The author appears to have little care for the success and sustainability of the management plan in our region and how it allows for the harvesting of local sockeye, pinks, silvers and chums.

I wish all the best to the user-groups of the Cook Inlet Region and hope that in the near future the user groups and management will be able to work together for more peaceful fisheries and sustainable and strong runs in that region.

I strongly encourage the Board to reject this proposal.

Thank you for your careful consideration,

Alex and Jaime Roth
F/V Wandering Star
Homer, AK

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

Bo Calhoun 57177 Zulu Ct. Homer, AK 99603 12/26/19 RE: Opposition to Proposal #64 Dear Chairman Morisky and Board of Fish members: I'm a third generation Kodiak salmon seiner. I was born in Homer, raised in Port Lions and Homer, and continue to live in Homer. My wife and I hope to raise our two sons on our family seine boat in a healthy Kodiak salmon fishery. I respectfully request you reject Proposal #64. The genetic study this proposal is based on lacks the necessary data to show the trend the proposer assumes. The data in the study, especially from 2016 Cape Igvak section, was extremely anomalous and incomplete. Many areas, including Cook Inlet and Chignik also catch mixed stocks, including salmon returning to Kodiak. The Mixed Stock Fisheries Policy should be applied evenly to all areas of the state and the application of highly disruptive prescriptive management restrictions like those proposed here should only be based on long term trends demonstrated by studies with sufficient data. Please reject proposal #64. Thank you for taking the time to read public comments. Sincerely, Bo Calhoun

Brad Marden
PO Box 2856
Homer, AK 99603

December 23, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: **opposition to Proposal 64**

Dear Chairman Morisky and Board of Fish members:

I first participated in the Kodiak seine fishery for salmon in 2004. Since then, I've worked as a deckhand in various salmon, halibut, and herring fisheries throughout the state (including work on Upper Cook Inlet drift boats), before buying my own boat in 2012, followed by a Kodiak seine permit in 2013. Since then I have exclusively fished in Kodiak waters. I respectfully request the Board **reject Proposal 64**.

This proposal is accusatory and inaccurate, as it seems to portray the Mainland District of KMA as an unorganized fishery without concern for fisheries conservation. This is simply not true. "Seaward" and shoreward" zones for Kodiak seiners fishing the Mainland district already exist, thanks to the North Shelikof Strait Management Plan. This 'hard cap' style of fisheries regulation is draconian enough, and often hamstrings Kodiak biologists when attempting to effectively manage local mixed stocks, so we don't need to go further down this road. Fishing opportunity in the Mainland District fishery helps spread out our fleet and can be an important part of having a decent fishing season for Kodiak fishermen. Fisheries managers are already empowered with a variety of tools to manage the Mainland District and can do their job best when allowed flexibility.

I am sure that the Board tires of endless testimony claiming that the fish of concern are "our fish being stolen by those guys over there". It seems that in my 15 years of commercial fishing in Alaskan waters, Kodiak salmon fishermen are often the scapegoat. Rather than passing the blame along to the next guy, I ask that we consider proposals with more merit and less collateral damage. For this reason, I ask that you **reject Proposal 64**. I want to thank you for your service and I hope the Board continues to apply consistency in upholding Mixed Stock Fisheries Policy, and the Sustainable Fisheries Policy.

Sincerely,

Brad Marden

Brian Mcwethy
KSA
12/23/2019 09:28 AM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

My name is Brian Mcwethy. I was born and raised in kodiak. I live in kodiak with my family and we all depend on my income. I fished with my father on his seiner growing up and now I own and operate a seiner. Salmon seining and tanner crab fishing in kodiak are currently our only sources of income. I plan to try and continue to fish the kodiak waters and possible my children will have the opportunity to. I hope the current and historical areas we fish aren’t taken from us and the future generations of kodiak. I oppose proposal 64. This proposal would dramatically reduce Kodiak seiners historical fishing area and reduce our ability to harvest local pink and chum salmon. In an area that is very unfriendly to fish sometime the only area to safely fish with a seine is outside the cape. I have based my business plan on being able to fish historical areas.

December 22, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 64

Dear Chairman Morisky and Board of Fisheries Members,

My name is Chris Johnson and I am a second-generation fisherman in Kodiak, Alaska. I grew up fishing on my dad's boat and got my first crew job working for someone else two weeks after I graduated high school. I haven't missed a salmon season since. I bought into the fishing industry in 2011 with the purchase of a 25-foot jig boat that I worked for two years in the winter and spring months while I still crewed for salmon in the summer. Access to the jig fisheries focusing on cod and rockfish was the only way that I could afford to move into the salmon fleet with a 38-footer in 2013. After the recent cod collapse, I now primarily rely on salmon seining and live here year-round with my wife.

The author is grasping at a solution for a propositioned, yet unfounded, problem that came out of the genetic study in 2016. The genetic study showed nothing new, simply a confirmation of something already known – that Cook Inlet origin sockeye sometimes swim through Kodiak waters. Placing a cape to cape line on the mainland would hamstring the ability of Kodiak fishermen to harvest local pink, silver, and chum salmon.The Kodiak Management Plan is a solid plan that has a proven working track record.

Taking away any fishing opportunity from Kodiak fishermen, particularly from the small boat fleet, would have a direct negative impact on new entrants trying to gain a foothold in this industry, fishing families trying to get by, and fishing support businesses in our region. I'm proud to call Kodiak home and am working to protect our fishing way of life.

Sincerely,
Chris Johnson
F/V North Star

December 22, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 64

Dear Chairman Morisky and Board of Fisheries Members,

My name is Danielle Ringer and I appreciate the opportunity to comment on proposals before the Board in writing and in person for the Kodiak finfish meeting. I live in Kodiak with my husband and we own and operate the 38-foot F/V North Star. We chiefly rely on salmon seining and cod and rockfish jigging to maintain our fishing way of life and ability to live on Kodiak Island. I grew up in Homer learning to harvest and process fish from my parents in Kachemak Bay and dipnetting on the Kenai River. I hold a Master's degree from the University of Alaska Fairbanks in Political Ecology of Fisheries and was one of the researchers on the *Graying of the Fleet in Alaska's Fisheries: Defining the Problem and Assessing Alternatives* study in the Kodiak region.

The author is grasping at a solution for a propositioned, yet unfounded, problem that came out of the genetic study in 2016. The genetic study showed nothing new, simply a confirmation of something already known – that Cook Inlet origin sockeye sometimes swim through Kodiak waters. Placing a cape to cape line on the mainland would hamstring the ability of Kodiak fishermen to harvest local pink, silver, and chum salmon and raise serious concerns and precedents about the underlying foundation of common property fisheries in the State of Alaska.

The Kodiak Management Plan is a solid plan that has a proven working track record. The proposer appears to have little understanding of the management plan in our region and how it allows for the harvesting of local sockeye, pinks, silvers and chums.

I see no biological, scientific, historical, economic, nor sociocultural reasons that could justify the Board making any changes to the salmon management plans in the Kodiak Management Area, which would create ripple effects negatively impacting Kodiak fishermen, processing workers, and community businesses. Thank you for your consideration of my comments and I look forward Board of Fisheries members spending time in our fishing community during the Kodiak meeting.

I humbly request the Board to reject this proposal.

Respectfully,
Danielle Ringer, M.A.
F/V North Star

Dave Kubiak
F/V Lara Lee
12/21/2019 02:20 PM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

Incidental catches of Cook Inlet bound sockeye in Kodiak waters is nothing new, as salmon move with the winds, tides, and currents. Incidental catches of Cook Inlet salmon have been addressed in the Kodiak Salmon Management Plan. This proposal would have harsh economic consequences for Kodiak salmon fishermen targeting their own local stocks while not changing Cook Inlet's essential problems.

Donald Lawhead

12/26/2019 11:01 PM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

The mangement plans already have caps and time restrictions.

Fred Stager

F/V Lady Lu

December 12, 2019

Alaska Board of Fisheries Board Support Section

P.O. Box 115526 Juneau, AK 99811-5526

RE: Opposition to Proposal 64

I can't present a better argument than the Kodiak Seiners Association has:

This proposal (proposal 64) represents and perpetuates an amalgamation of misconceptions concerning the salmon fishery in the Kodiak Management Area (KMA). First and foremast is the implication that Kodiak currently bears no burden of conservation of Cook Inlet (CI) stocks and that we are essentially operating in the absence of regulations that substantially restrict harvest. The North Shelikof Straight Management Plan was established with the intention of annually limiting the harvest Cook Inlet bound sockeye regardless of run strength. This means that on years of abundant CI stocks higher harvest rates trigger early closures of the seaward zones which then remain closed until July 25th, depriving the fleet of substantial fishing opportunity in an effort to conserve a fishery that is chronically under-harvested while also inhibiting the harvest of our local stocks.

Additionally, the Mainland District, which includes the Cape Igvak section, is the most stringently managed area in the KMA during the time of consideration for this proposal. Kodiak fishermen are only allowed a maximum of four 57-hour openings in the mainland district before August 1st. These openings cannot be extended regardless of the abundance of local and non-local stocks. The Wide Bay section does not open before July 25th, and it is not unusual for the Cape Igvak section to remain closed until July 25th as well, long after the peak of the late Chignik and Cook Inlet

sockeye runs. There is no other district in the KMA that is so rigidly managed during this time frame, and the current management structure already provides insufficient opportunity to harvest local stocks.

The Board should also consider that the structure of the Cape Igvak management plan inherently acts to conserve CI stocks on the rare occasion that they are harvested there. Although the harvest

allocation for Igvak is set according to measures of abundance in Chignik, the harvest of any stocks counts against that allocation and will trigger a closure. Consider the anomalously high harvest rates of 2016. An abundance of what we now know were Cook Inlet stocks that were perplexingly swimming westward led to unusually high harvest rates, quickly triggering a closure of the Cape Igvak area which then remained closed for the rest of the season. Kodiak fishermen are always operating under strictly imposed harvest quotas at Igvak and these harvest caps apply regardless of the stock composition. For that reason, Igvak especially and the rest of the mainland in general are currently managed under a structure that provides maximum safeguards to CI stocks and minimal opportunities to harvest local stocks while prosecuting our traditional fishery.

Another glaring falsehood stated in this proposal is the claim that the KMA only has 7 streams with sockeye present. Kodiak has, in fact, 15 un-enhanced streams that are common sources of commercial harvest in addition to 4 major enhancement systems with associated terminal harvest areas. There are additionally numerous other minor wild systems and subsistence enhancement projects that contribute to mixed stock sockeye harvest in the KMA. A list of important sockeye systems that contribute to mixed stock harvest throughout the KMA is provided below:

Non-Enhanced (Wild) Systems	**Enhanced Systems**
. 1) Karluk . 2) Ayakulik	1) Spiridon 2) Kitoi . 3) Foul Bay

. 3) Frazer . 4) Upper Station . 5) Dog Salmon . 6) Saltery . 7) Pasagshak . 8) Buskin . 9) Litnik . 10) Pauls Bay . 11) Discovery Bay . 12) Thorsheim . 13) Malina Creek . 14) Uganik . 15) Kaflia	. 4) Waterfall Bay

Typical aggregate escapement numbers for these systems exceeds 1.5 million sockeye annually, and enhancement projects can contribute hundreds of thousands additional sockeye for harvest. These fish are widely distributed in the KMA both geographically and temporally, and sockeye bound for KMA systems are harvested throughout the season and in all districts, including the mainland district. It is unclear how the proposer concluded that Kodiak has only 7 sockeye runs only 2 of which are "of minor production status." In reality, 9 of Kodiak's rivers have weirs counting sockeye, and aerial surveys are common for numerous other systems, like Uganik.

It is our hope that the Board understands that the majority of sockeye harvested in Kodiak are of local origin and that our fisheries are responsibly prosecuted as directed harvest of local stocks of sockeye,

chum, pink, and coho salmon along with our historical and traditional harvest allocation at Igvak.

One of the most frustrating gaps in the greater public understanding of the mixed stock fishery in Kodiak is that we are prosecuting a mixed-stock, multi-species fishery. The recent publication of the genetic stock assessment focused public attention exclusively on the sockeye component of commercial harvest, while neglecting to provide harvest figures for the non-sockeye portion, which comprises the vast majority of fish harvested in Kodiak. For example, sockeye made up only about 6% of the fish harvested in the KMA in 2019, and even in July, during the period of concern for this proposal, Kodiak harvest was overwhelmingly pink and chum salmon. Efforts to curtail the harvest of sockeye in Kodiak, especially CI stocks which exhibit no predictable migration patterns in the KMA, would inevitably result in significant collateral damage in the form of lost harvest of local, pink, chum, and coho stocks that are largely the focus of our directed fishery.

This very situation highlights the fundamental reason why the Alaska Board of Fisheries adopted a mixed stock fisheries policy. Migrating salmon do not conveniently segregate themselves by species and stocks of origin, and they do not embark on predictable migration paths far away from their natal streams. As a result, non-local mixed stock harvest of salmon is inevitable in all Alaskan waters and attempts to manage our fisheries in order to somehow distill out non-local components will inevitably result in sub-optimal use of the resource.

The Mixed Stock Fisheries policy and its associated findings resulted from the acceptance that Alaska must manage its fisheries in a way that best complies with Article VIII of the Alaska state constitution which declares that, “Wherever occurring in the their natural state, fish...are reserved to the people for common use” and that fishery resources be “utilized, developed and maintained on the sustained yield principle” and finally that uses of the resource is available for “maximum use” and for the “maximum benefit” of Alaskans.

The purely allocative proposals offered to the Alaska Board of Fisheries for

this meeting would inevitably result in reduced yields of local stocks in addition to massive disruption of a long- established traditional fishery. If the Board were to apply the same reasoning presented in this proposal to management regimes throughout the state, then the net result would be to forsake the sustained yield principle as well as other constitutional statutes and Board policies. The uniform application of the reasoning found in Proposal 64 would inflict substantial economic losses for the state and most acutely for Alaska's coastal fishing communities. Ultimately, managing our fisheries for the maximum benefit and sustained yield standards means that we must accept that the unpredictable nature of salmon migration negates the unrealistic standard of purely localized harvest.

Although some user groups may lament the faraway harvest of what they consider to be *their stocks,* the policies that allow for this harvest were crafted with immense consideration of how to develop consistent management plans that when universally applied maximize the use of the resource and the benefit conveyed to Alaskans. Although it may seem intuitive to some that it is somehow inherently unfair for Kodiak fisherman to harvest Cook Inlet stocks, the Board should consider whether it would be fair for those same fishermen to sacrifice the harvest of hundreds of local fish

---

in order to potentially provide Cook Inlet waters with a single additional salmon from chronically under-harvested stocks.

Ultimately, Alaska's fisheries are dedicated for common use, and wholesale regional entitlement, which is asserted in this proposal, would violate the very foundational principles of our constitution. Although KSA strongly believes that subsistence users should be granted ultimate priority, there would be no value conveyed to the state by attempting to disrupt a historical fishery just to alter the geographic location of commercial harvest. There are no Board policies or legal statutes that direct managers to ensure commercial harvest be focused exclusively in the region of natal streams. As long as an established commercial fishery alone does not intrinsically threaten the biological sustainability of stocks or the ability to

provide subsistence harvest opportunities, then that fishery should not be disrupted simply to regionally reallocate commercial harvest.

Additionally, the Board should consider the importance of consistency in the application of their policies. Currently, Kodiak fishermen bear the sole burden of conservation of KMA stocks despite the documentation of substantial harvest of "East of WASSIP" stocks in Chignik and further south. While KSA is strongly ideologically opposed to meddling in the management of fisheries in adjacent areas, we also believe that whatever standards are applied *to* our fishermen must also be applied *for* our fishermen so that any further restrictions on harvest in the KMA designed to prevent the catch of non-local stocks must be coupled with restrictions to the south designed to prevent the unregulated harvest of KMA and Cook Inlet bound stocks in the Chignik management area and wherever else these fish may be present. After all, the legitimacy of the Board's reasoning is critically and inextricably dependent on the consistency with which its policies are applied.

Please **oppose proposal 64** and support the responsible application of the Mixed Stock Fisheries Policy in Kodiak. We believe that adopting this proposal would result in substantial and irreversible economic harm to our fleet community.

Thank You- Fred Stager

garrett kavanaugh

12/27/2019 05:20 PM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

Dear Chairman and Members of the Board, As a young fishermen who is working their way into the Kodiak Salmon fishery this proposal will cause Kodiak fishermen to lose a substantial amount of their catch. I have been investing into the Kodiak salmon fishery as much as possible, in 2019 I purchased a Kodiak salmon permit. I ran a seiner for the month of august. I plan on running the same boat for the entire 2020 salmon season in Kodiak. When I was younger I remember testifying against proposals similar to these. These proposals are re-allocations of Kodiak historical catch. Kodiak has always had intercept fisheries and we already have management plans in place that have been effective for the Kodiak salmon fishery. Please help ensure the future for young fishermen entering into the Kodiak Salmon fishery, and the people who have been investing and are established in the fishery. Thank you for considering these comments, Garrett Kavanaugh

Iver Holm

12/28/2019 12:28 AM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

Dear Chairman Morisky and Board of Fish members: I am 31 years old and a life long resident of Kodiak. I grew up set netting in Uganik on the west side of the island with my mother until i was 14. I then started seining with my father until I was able to buy my own Kodiak seine operational the age of 27. Please oppose proposal 64. thank you for your time sincerely
Iver Holm

James Calhoun

12/26/2019 03:53 PM AKST

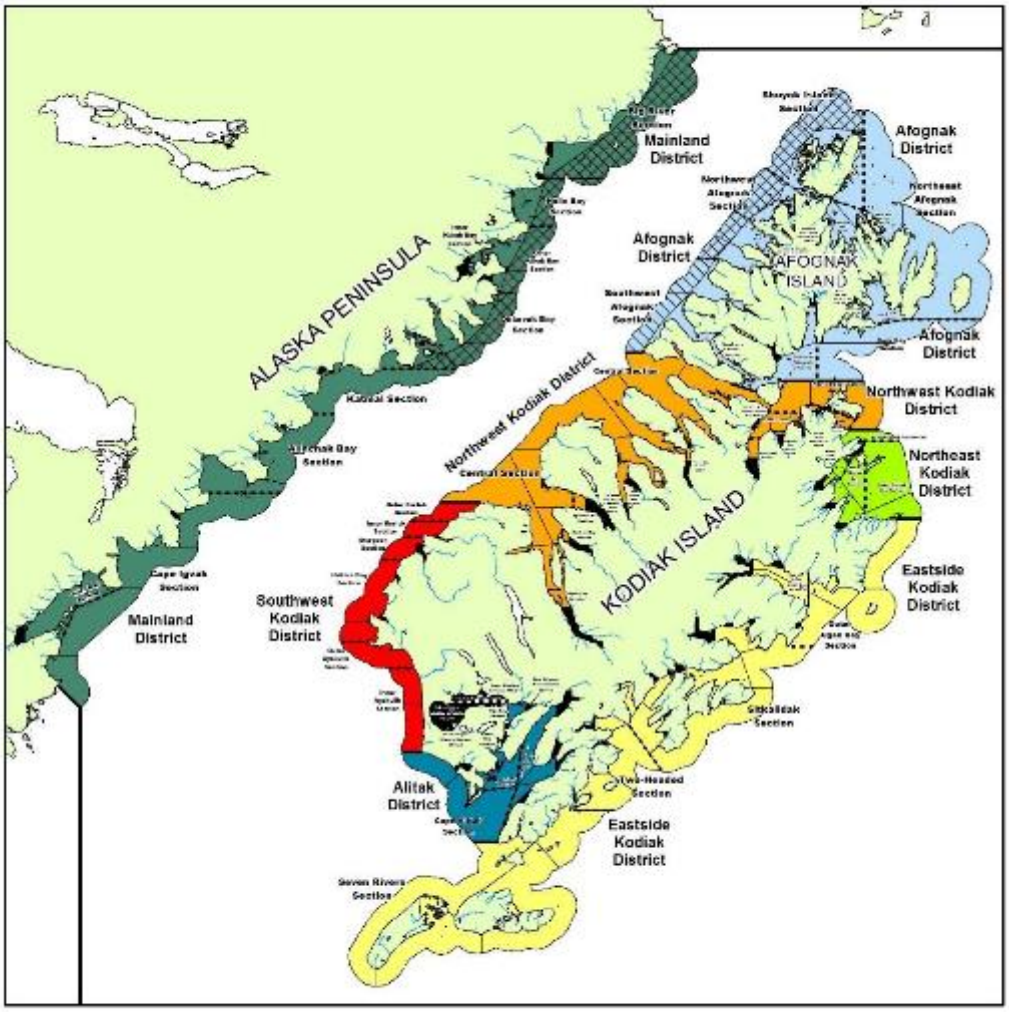
RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

I have been intimately involved in the Kodiak seine fishery since 1968 to present. Presently my son is fishing the Kodiak area and it is my desire to have my grandsons be able to participate in a healthy Kodiak fishery if they so desire. Throughout my career I have come to the conclusion that the ADF&G management for Kodiak has been stellar and has kept the stocks in Kodiak healthy overall with the current management plan. It is well known area M, Chignik, Kodiak and Cook Inlet intercept fish going to other areas. As far back as 1957 fish tagged in Seldovia Bay by Tyler and Noerenberg indicate the pink salmon were returning to streams in PWS and both sides of Kodiak Island. Every area has mixed stock fisheries.To single out Kodiak based on a genetic study in 2016 based on a catch rate and event that I had never seen or heard of before or since, is not good science. It was truly an anomaly quaint as that phrase maybe. If the board is going change a very good Kodiak management plan of local stocks developed over decades of experience, then all areas should be subjected to the same policy. please oppose proposal 64. thank you

Ken Christiansen
F/V Mary Ann
12/26/2019 03:40 PM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

In my opinion this is just a means for one user group to take away from another user group to try fix a problem that can be dealt with internally. Targeted interception of Cook Inlet bound sockeye ended in 1989 with creation of North Shelikof Sockeye Management plan



Economic Analysis of the Cumulative Impacts from Proposals 64 and 58.

Kodiak Salmon Workgroup

Summary:

The cumulative effects of all Cape Igvak proposals would close the fishery entirely before July 25th in all years (proposals 58 and 64). There would be additional restrictions due to the harvest minimums in Chignik area being raised to 600,000 (proposal 61). Assuming these closures, the reduction of Cape Igvak harvest to 5% of total Chignik sockeye count (proposal 60) would result in no additional limits on Cape Igvak harvests.

Cape Igvak Cumulative Direct Losses

On average, the cumulative effects of Cape Igvak Proposals 58, 60, 61, and 65, will result in more than 95% reduction of the current catch. Overall, these changes would result in an economic loss to the Borough of almost 3.23 million dollars a year.

Direct revenue lost to the Kodiak Borough per year:

$2.15 Million Dollars Yearly Direct Loss to Fishermen

$3.23 Million Dollars Annual Economic Loss in the Kodiak Borough

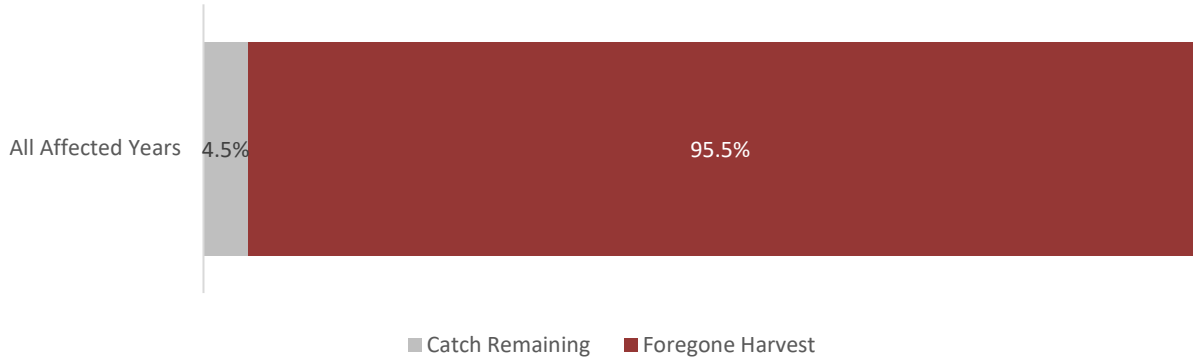
Direct loss per affected year:	**$2.15 Million**
Loss from sockeye fishery:	$1.77 Million
Fisheries employment impact:	19 jobs per year
All employment impact:	23.8 jobs per year
Indirect community loss:	$446,401
Induced community loss:	$628,960
Total Annual Borough Loss:	**$3,225,653**

The cumulative effects of the Cape Igvak proposals would have impacts throughout the Kodiak Borough. The direct loss to fishermen would be $2.15 million per year. Of the total loss to the fishery, the limitations on the sockeye fishery comprise the majority of the impact, accounting for $1.77 million of the loss with $380,000 of the total loss distributed among other salmon species.

The direct impact of this proposal will result in a loss of 19 fisheries specific jobs and a total of 23.8 jobs overall in the Kodiak Borough per year. In addition to the direct loss impact of $2.15 million, there is a further indirect loss of $446k as a result of lost business to business economic activity for the community from purchases such as fuel, gear, and supplies. There is an additional $629k of induced loss in the community resulting from the lost direct and indirect economic activity (total $2.60 million) and reduced labor market. This impact results in a total loss to the community from direct, indirect, and induced losses of $3.23 million per year.

Fisheries Loss

Chart 1: Average Revenue Loss Per Year



On average, restrictions during the affected years would result in more than 95% of the current catch being eliminated. 21 of the 22 years are affected. Over the last 22 years 1998-2019, there have been 18 years where the fisheries losses from these increased restrictions would result in a loss of more than 500k dollars of foregone ex vessel value to the fishery. One of the previous 22 years would be unaffected by the proposed changes. Fishing was severely restricted in 2018 due to historically low run returns.

The sockeye fishery would experience ex vessel losses of more than $500k for 15 of the 21 affected years.

Chart 2: Total Fishery Loss 1998-2019

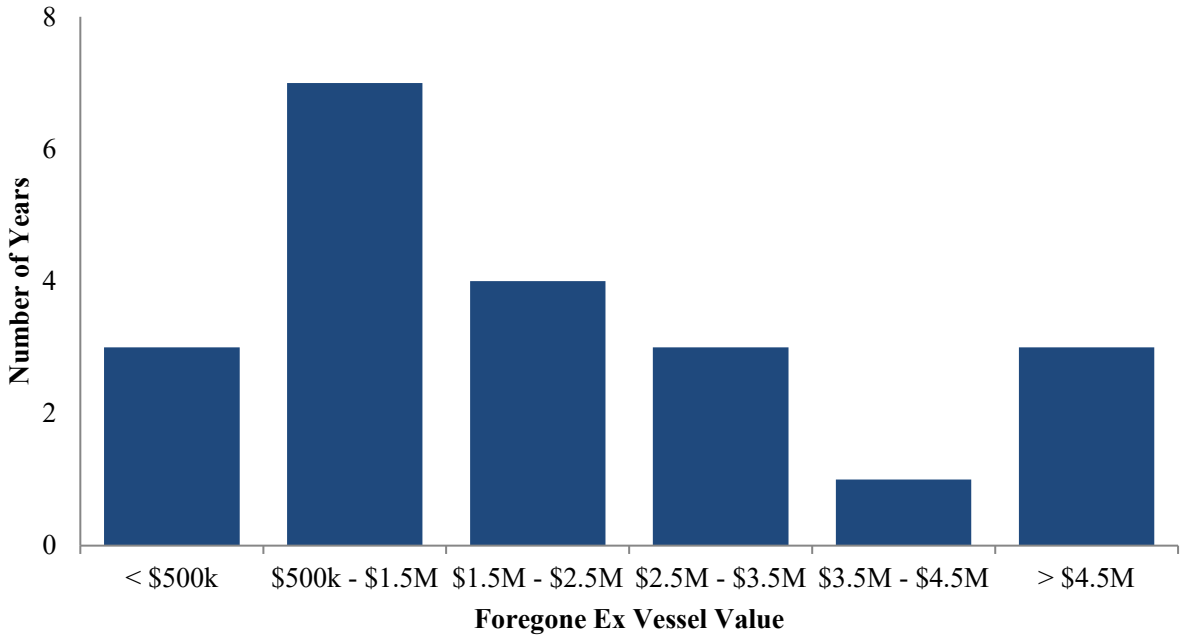
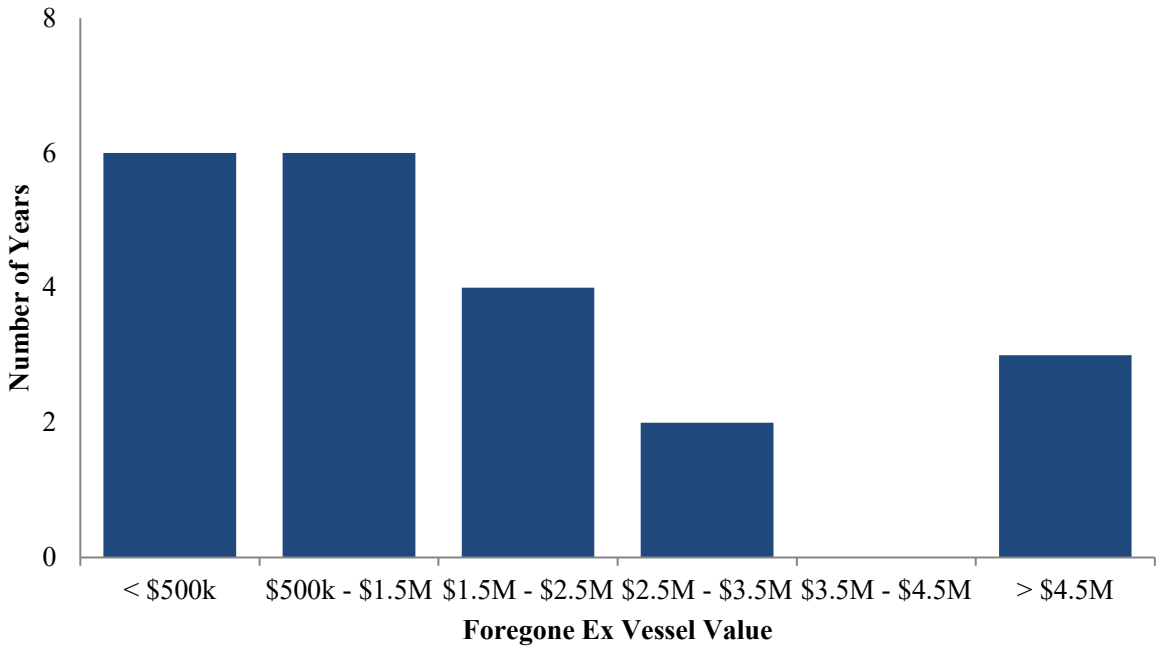


Chart 3: Total Sockeye Loss



The mean direct loss for all species per year is $2,150,292 with a median loss of $1,732,055. If these restrictions were in place the greatest impact would have been in 2011 with a loss of $6,644,239 and the least impact would have been in 2014 with a loss of $54,444.

Table 1: Direct Loss of Cape Igvak Proposal Implementation

Year	Direct Loss All Species	Direct Loss Sockeye
1998	$132,121	$91,646
1999	$5,619,379	$5,149,012
2000	$3,097,396	$2,831,444
2001	$2,048,165	$1,640,725
2002	$851,413	$799,675
2003	$719,506	$639,835
2004	$898,710	$869,284
2005	$2,217,289	$1,975,671
2006	$528,224	$241,350
2007	$546,640	$463,954
2008	$703,717	$144,405
2009	$1,732,055	$1,183,727
2010	$2,319,549	$1,873,907
2011	$6,644,239	$6,238,496
2012	$3,806,759	$3,482,478
2013	$5,663,632	$5,199,632
2014	$54,444	$29,775
2015	$344,912	$43,676
2016	$2,761,597	$2,462,796
2017	$1,331,454	$1,198,552
2019	$3,134,923	$559,916
Mean	**$2,150,292**	**$1,767,617**
Median	**$1,732,055**	**$1,183,727**
Min	**$54,444**	**$29,775**
Max	**$6,644,239**	**$6,238,496**

Table 2: Direct Loss of Cape Igvak Proposal Implementation Per Fishermen

	Average Loss Per Fishermen – All Species	Average Loss Per Fishermen – Sockeye Only
Mean	**$37,320**	**$26,004**
Median	**$25,286**	**$20,256**
Min	**$9,224**	**$2,730**
Max	**$87,965**	**$76,079**

Based on the number of active permits per year, individual fishermen would experience a mean direct loss for all species per year of $37,320 with a median loss of $25,286. If these restrictions were in place the greatest impact in the sockeye fishery would have been in 2008 with a loss of $87,965 per fishermen with the least impact in 2003 with an average loss of $9,224.

.

Table 3: Loss Per Affected Permit Holder

Year	Permits	Loss per Permit	Total Value Foregone Harvest	2019 Inflation Adjustment
1998	10	$13,212	$83,727	$132,121
1999	126	$44,598	$3,639,494	$5,619,379
2000	126	$24,583	$2,073,223	$3,097,396
2001	81	$25,286	$1,409,611	$2,048,165
2002	69	$12,339	$595,394	$851,413
2003	78	$9,224	$514,668	$719,506
2004	37	$24,289	$659,846	$898,710
2005	71	$31,229	$1,683,590	$2,217,289
2006	46	$11,483	$413,969	$528,224
2007	36	$15,184	$440,484	$546,640
2008	8	$87,965	$588,885	$703,717
2009	28	$61,859	$1,444,583	$1,732,055
2010	71	$32,670	$1,965,720	$2,319,549
2011	82	$81,027	$5,812,982	$6,644,239
2012	60	$63,446	$3,398,892	$3,806,759
2013	78	$72,611	$5,130,102	$5,663,632
2014	5	$10,889	$50,133	$54,444
2015	16	$21,557	$317,892	$344,912
2016	63	$43,835	$2,576,117	$2,761,597
2017	83	$16,042	$1,269,261	$1,331,454
2019	39	$80,383	$3,134,923	$3,134,923
Average		**$37,320**	**$1,771,595**	**$2,150,292**

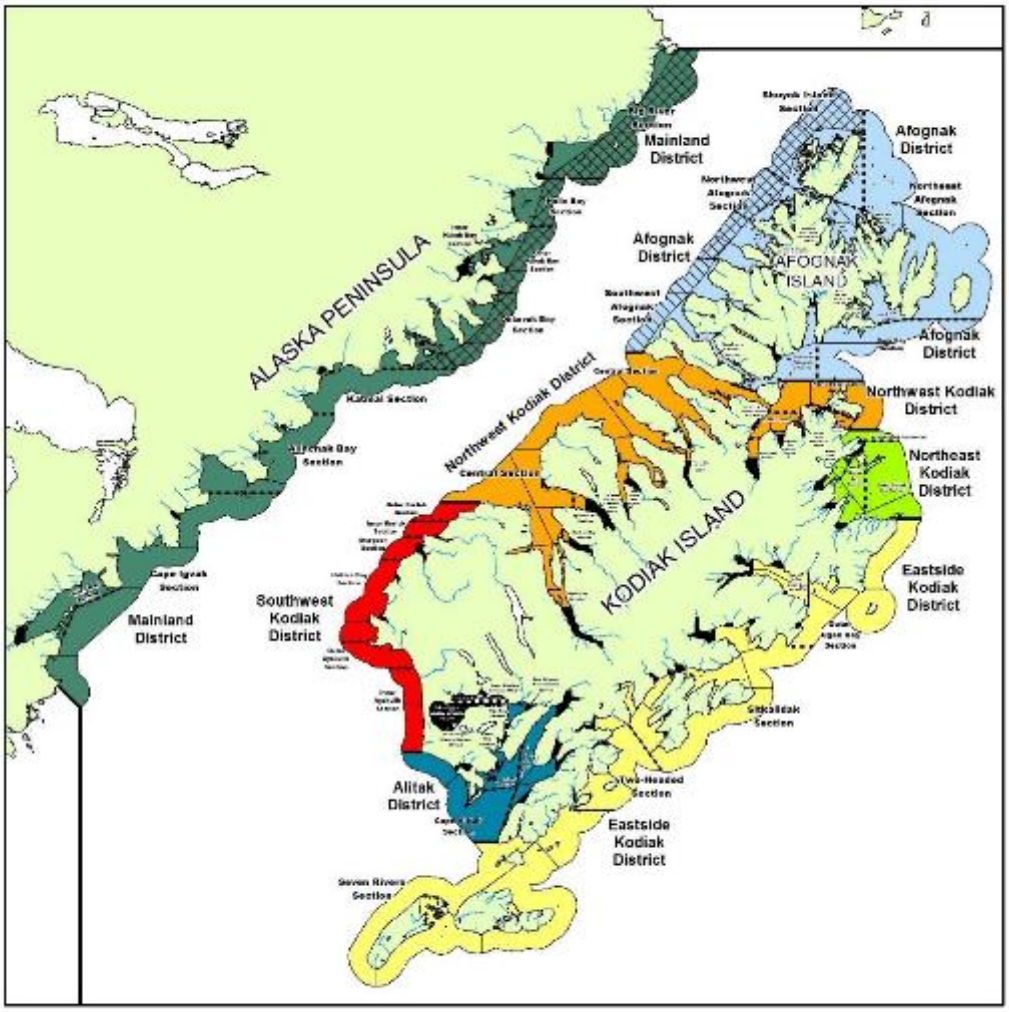
Foregone Tax Revenue

State Taxes	
Fisheries Business Tax (50% Share)	$34,405
SET Tax	$43,006
Total	**$77,410**
Borough	
Resource Severance Tax	$23,116
Fisheries Business Tax (Share of 50%)	$10,987
Total	**$34,102**

Cities	
(Share of Fisheries Business Tax)	
Akhiok	$2,564
Kodiak	**$10,239**
Larsen Bay	$2,562
Old Harbor	$2,751
Ouzinkie	$2,659
Port Lions	$2,643
Total	**$23,418**

The foregone harvest due to Cape Igvak Proposal Implementation would have tax implications for state, borough, and city budgets. The state implements two relevant taxes in the region: the fisheries business tax (which is shared with local governments) and the salmon enhancement tax (SET). Fisheries business tax rates vary by type of processing activity and the proportion of each is estimated from the State of Alaska's Annual Tax Report for FY18. The salmon enhancement tax rate is 2% in the Kodiak region. The Borough implements a resource severance tax of 1.075% and receives a share of the fisheries business tax from the state. The local city governments also receive a share of the fisheries business tax from the State of Alaska. Borough and city shares of the fisheries business tax estimated from the Borough's FY18 annual tax report.

The implementation of these proposals would result in average yearly tax losses of $77,410 to the State of Alaska, $34,102 to the Kodiak Borough, and $10,239 to Kodiak City.



Review of Genetic Studies of Sockeye Salmon Harvests in the Kodiak Management Area

Kodiak Salmon Working Group

Executive Summary

- Recent genetic analyses in Kodiak Management Area provide accurate and precise estimates of sockeye salmon stock proportions and harvest numbers in targeted Westside Kodiak fisheries, during monthly (June, July, August) time periods in 2014-2016. Very limited sampling occurred at Cape Igvak.

- The study was not designed to understand migratory patterns of sockeye salmon through KMA, nor to address finer temporal patterns of non-local stock distribution which might describe rapidly changing abundance of migrating stocks in specific areas. WASSIP results showed that proportions of one non-local reporting group varied by as much as eight fold in weekly samples of Shumagin Island and Dolgoi June fisheries harvests, 2007-2008.

- Harvests of Cook Inlet sockeye in KMA fisheries varied by an order of magnitude between study years and between monthly samples within a year. Incidental harvests in 2015 were particularly divergent, especially for July harvests, during an exceptionally large pink salmon run. The widely divergent harvest proportions of Cook Inlet fish in this three year study suggest no reliable patterns upon which to base specific management actions.

- Susitna bound fish overall represented the smallest component of Cook Inlet stocks incidentally harvested in KMA and accounted for less than

2.5% of total KMA sockeye harvest in 2014-2016 and less than 4.5% of annual harvests in the sampled areas. Due to high estimated harvest rates of Susitna fish in Cook Inlet fisheries (average 38% 2006-2015) and large uncertainties in Susitna escapement estimates, it is unlikely that effects of any "savings" of these stocks in KMA fisheries could be measured with any confidence.

- In 2014-2016, estimated harvest of Susitna fish in Upper Cook Inlet fisheries was 3 fold to more than 40 fold greater than in KMA. Any conservation efforts for Susitna fish should be addressed in Cook Inlet fisheries.

- Data from Cape Igvak is limited to harvests in three temporal periods from two years. Incidental harvest of Cook Inlet fish varies by two orders of magnitude (50 fold) among those strata.

- Evidence suggests that management plans in KMA are working well, as all key sockeye stocks on the Westside are achieving their escapement goals and odd year pink salmon goals are consistently met.

Study Purpose and Design

The purpose of Shedd et al. (2016) was to use Genetic Stock Identification (GSI) methods to estimate temporal stock contribution to select Kodiak Management Area (KMA) sockeye fisheries during 2014-2016 by sampling major sockeye fisheries where significant harvest of salmon occurs (Foster and Dann, 2014, 2015). At its inception, the study

intended to meet multiple information needs. Some local fishermen were interested in a sampling program that could identify particular stocks in area fisheries, especially Alitak-bound fish harvested in Westside fisheries. Fisheries interests outside of Kodiak desired a better understanding of harvests of “non-local” sockeye salmon in Kodiak area fisheries; and area biologists who sought to understand production dynamics of area stocks wanted better stock-specific harvest information for improvement of brood tables, run-reconstructions, and escapement goals for local stocks. Funding constraints resulted in a limited geographic scope for the study.

The work provided accurate and precise estimates of stock-specific harvests for six Westside fishery areas within the KMA over approximately monthly time periods (June,July, August), during the years 2014-2016. Much more limited sampling occurred in Igvak fisheries. Within this scope, it is a robust study which uses state of the art analytic and statistical approaches to generate estimates for sampled areas and times. It has contributed to brood table improvement for area sockeye stocks, especially Karluk and Ayakulik (ADFG, pers. comm).

As the author notes, the study was not designed to understand migratory patterns of sockeye salmon through KMA (Shedd et al., 2016). The design also does not address finer temporal scale patterns of non-local stock distribution which might describe rapidly changing abundance of migrating stocks in specific areas, or address broader questions about sockeye migratory characteristics in and around Kodiak Island outside of sampled areas. Both are important to inform policy debate on allocating harvests from one management area to another.

Finally, there is no information provided on harvest rates to provide context for actual impacts of non-local stock harvest in Kodiak area

fisheries. An understanding of stock-specific harvests with respect to run sizes (i.e., harvest rates) for those non-local stocks is essential for discussing perceived conservation issues (Habicht et al., 2012).

Sampling

Samples for genetic analyses were gathered at fish processing facilities in Kodiak, Larsen Bay and Alitak. Through close communication with processors, samplers could be in place at facilities when deliveries occurred. Efforts were made to ensure samples only represented fishing in one of the management areas intended for sampling and were taken only from deliveries that could be attributed to the intended area. Deliveries from multiple study areas were not sampled. In Uganik/Kupreanof portion of the NW Kodiak district, where both set gillnet and purse seine vessels contributed to harvests, most samples were taken from set gillnet harvests because seine vessels often had mixed loads (ADFG, pers. com.). Brennan et al., (2017, this volume) point out that gillnets used there are selective for larger fish and sampling from mostly this gear group in Uganik/Kupreanof could bias samples towards Cook Inlet harvests because Cook Inlet sockeye are typically larger fish than Karluk Lake sockeye.

Samples from specific area harvests were collected a number of times, often weekly or more often, throughout the monthly sampling stratum when fish were delivered (Shedd at al., 2016 and ADF&G pers. comm**.**). Samples were taken on specific dates from fish available on that date. It is not completely clear how samples were randomized within a delivery, but generally, the target sample number (100-400) was taken from the delivery and placed in a separate tote for sampling. These samples represented a bulk sample of tissues from fish for that date. Typically, at least four bulk

samples were acquired during monthly periods for each area. Each sample represents the group of fish delivered on a one or two day period (see Shedd et al. 2016, Appendix B for details).

Post-season, samples for genetic analyses were selected from date-specific bulk samples in proportion to daily harvests for that month, and combined to generate a monthly stock contribution estimate. Previous reviewers of the study have found the general approach of stratified random sampling, sampling in proportion to the harvest and sample sizes to be defensible (Geiger and Quinn, 2017, this volume). To summarize the sampling approach:

- Sampling was adequate for generating monthly estimates of stock-specific sockeye harvest in targeted areas. Samples were collected periodically through the month, and care was taken to ensure that sampled deliveries were from intended fishery areas. Samples selected for analysis were taken from all bulk samples in proportion to the harvest for the month.

- Sampling was not designed to identify times and areas where non-local stocks are most prevalent in KMA or to provide comprehensive information on migration patterns. The study estimated stock proportions and harvests from targeted areas in select Westside fisheries and Igvak using monthly time periods.

- Spatial resolution was limited to major Westside KMA fisheries including Uganik/Kupreanof, Uyak, Karluk/Halibut Bay, Ayakulik/Sturgeon and Alitak, and Cape Igvak in the Mainland District. There are no comprehensive mixed stock analyses for

fisheries in Afognak, Eastside District, Olga Bay, Special Harvest Areas, nor for harvest after August 29, presumed to be mainly local stocks. Authors estimate that sampled areas represented 47-62% of Kodiak sockeye harvest in 2014-2016.

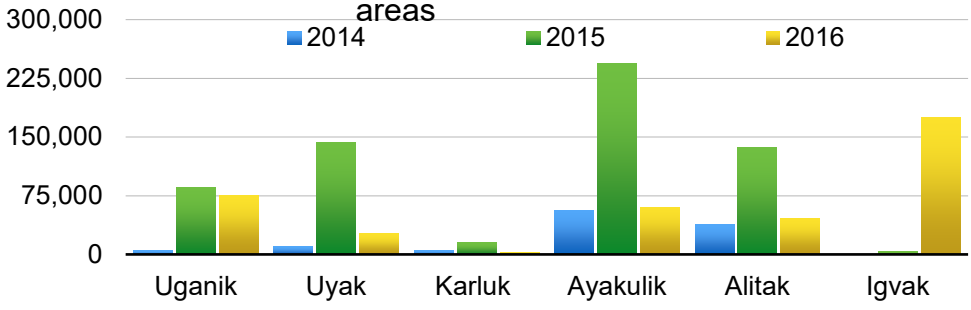
- Temporal resolution was limited to stock compositions for June, July, and August. The periods roughly coincide with fishery management approaches during each period, where early sockeye stocks are harvested in the early stratum (June), pink salmon and sockeye stocks in the middle stratum (July), and late sockeye and pink salmon in the late stratum (August). Harvest stock composition within the monthly periods was not examined.

Results: Variation within and between years

Cook Inlet Stocks

There are very large inter-annual differences among sampled areas in KMA for harvest of Cook Inlet genetic reporting group. Annual estimates

Figure 1. Annual harvests of Cook Inlet bound sockeye salmon within individual Kodiak Management sub-areas



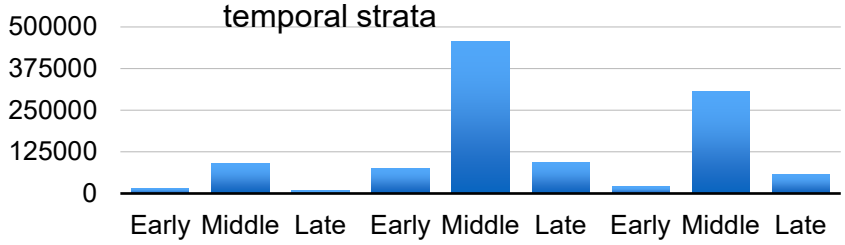
of Cook Inlet harvest numbers for all sampled KMA fisheries varied by an order of magnitude between years, especially evident for Uyak, Ayakulik/Sturgeon, and Alitak, where 2015 estimates far exceeded either

adjacent year. Uganik/Kupreanof harvests of Cook Inlet fish in 2016 were comparable to those in 2015 and Igvak had a single, large catch of Cook Inlet stocks in July 2016. Estimated harvests of Cook Inlet reporting group in 2014 were uniformly small for all sampled areas (Figure 1).

It is also clear that incidental harvest of Cook Inlet sockeye stocks in July (middle stratum) were dramatically larger than early or late strata in 2015 and 2016 (Figure 2). This is particularly pronounced for Alitak and Ayakulik/Halibut Bay harvests. For the Alitak District, harvests of Cook Inlet stocks in July (middle stratum) were an order of magnitude higher than early or late strata in all years. Harvests were more than three times larger in 2015 than middle strata in 2014 or 2016 (Figure 3). July (middle stratum) harvests of Cook Inlet stocks in Ayakulik/Halibut Bay were also highest in all years, and much higher in 2015 (Figure 3).

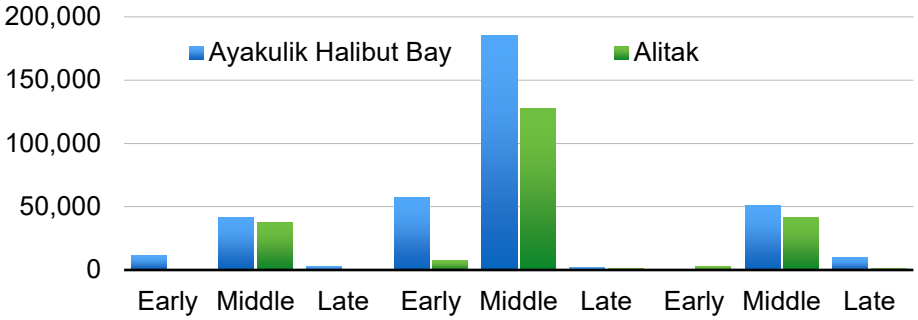
Higher incidental harvest of non-local sockeye in 2015 are likely associated with a very large pink salmon run. At 33 million, pink salmon harvest in 2015 was more than 3 fold larger than 2014 and roughly ten times greater than 2016 (Anderson et al. 2016). The large abundance of pink salmon in 2015 resulted in management actions to increase fishing time. Westside commercial fishing periods in 2015 were extended twice in July and many were open for the majority of August (Anderson et al., 2016). Larger incidental harvests of Cook Inlet sockeye in Westside

Figure 2. Harvests of Cook Inlet bound sockeye salmon in Kodiak Management Area among all sampled areas and years, by temporal strata



isheries during 2015 may partially be explained by pink salmon bundance, reflecting management actions in complex, multi-species fisheries.

Figure 3. Harvest of Cook Inlet bound sockeye salmon by temporal strata, over all years, in Ayakulik/Halibut Bay and Alitak sub-areas of KMA.



While Shedd et al. (2016) is the first genetic stock identification study to focus on KMA, it is modeled after the large WASSIP study which also revealed wide variation in stock specific harvests between and within sampling years, especially for those fisheries known to harvest a mixture of stocks on the South Alaska Peninsula (Dann et al., 2012). The East of WASSIP (EOW) reporting group in that study is a good example. It represents mixed stock analysis assignments made to stock groups beyond Chignik, the Eastern boundary of WASSIP. Specific stock composition of EOW reporting group is unknown, but it likely contains significant and variable proportions of Kodiak, Chignik and Cook Inlet stocks.

- For the Western and Perryville Districts within Chignik Management Area, samples from the same 10 day time interval in July (7/20-7/31) showed EOW reporting group harvest proportions more than twice as high in 2007 (38.8%) as 2008 (14.9%).

- For the Shumagin Islands June fishery, large differences were also observed for the EOW reporting group proportions among years and within weekly sampling periods. In 2006, among three sampled strata in June, EOW proportions ranged from 18.6% to 43.6%. In 2007, proportions for the same weekly strata ranged between 4.9% and 16.5%. For comparable strata sampled in 2008, the range was 9.4% to 10.6%. Over the three year period, harvest proportions for EOW reporting group in Shumagin June fisheries varied nearly nine fold within the month of June.

- For Dolgoi Area June fisheries, among weekly strata, proportions of EOW reporting group ranged from 17.1% to 39.5% in 2006, 35.8% to 56.2% in 2007, and 7.4% to 27.4% in 2008. EOW proportions varied by nearly 8 fold in Dolgoi within and among years in the WASSIP study (Dann et al., 2012).

Both WASSIP investigators and Shedd et al. (2016) express pointed caution about making inferences beyond their three year study periods. Like any GSI study, the data represent environmental and fishery conditions during those years and changes in relative proportions of reporting groups will be influenced by prosecution of fisheries and ocean conditions (physical and biological) which affect fish migrations. The wide

variation observed in WASSIP between weekly sampling intervals among years demonstrates how much stock specific harvests may change within a monthly period. The broad inter-annual variation in WASSIP and the recent KMA study should emphasize the inherent uncertainty in our understanding of stock vulnerability to commercial fisheries from year to year and within a fishing season.

Results: Measuring Impacts

Shedd et al., (2016) showed that over a three year study period, highly variable numbers of Cook Inlet sockeye salmon were harvested in KMA at some locations and times. However, these data alone provide little insight into impacts of these non-local harvests on Cook Inlet runs. Fishery stakeholders in the WASSIP study, from Area L to AYK, insisted that reporting of stock proportions be accompanied by harvest rates, so that stock-specific harvests could be assessed in relation to their respective run sizes (Habicht et al., 2012). The importance of this exercise is clearly demonstrated by WASSIP data for Outer Port Heiden (OPH) harvests during 2007-2008. Among six sampled time strata for OPH fisheries in 2007-2008, Bristol Bay stocks represented 65%-90% of the sample, while harvest rates on Bristol Bay fish for the same two years were less than 1% (Dann et al., 2012, Habicht et al., 2012). Significant numbers of sockeye bound for Bristol Bay were harvested in OPH, with negligible effect on the overall run.

Though no harvest rates were reported, Shedd et al. (2016) produced analyses to distinguish among four different genetic reporting groups within broader Cook Inlet harvests, including Susitna River, a currently designated stock of concern (Shedd et al., 2017). Overall, Susitna fish represented the

smallest component of incidental Cook Inlet harvests in KMA, representing 0.3% to 4.4% of KMA commercial sockeye harvests in sampled fisheries during 2014-2016 (Shedd et al., 2017). They represented only 0.1% to 2.4% of the total KMA sockeye harvest for study years 2014-2016.

Having dispensed with a biased sonar program (Fair et al., 2009), assessment of escapement for Susitna sockeye is now made by three weirs on Judd, Chelatna and Larson Lakes. Based on mark-recapture experiments in 2006-2008, Fair et al. (2009) estimated that combined Chelatna and Judd Lake escapements represent about 42% of Yenta drainage escapements and Larson Lake represents roughly 52% of mainstem Susitna escapement. Escapement goals for these lakes were established in 2017. Over the last decade, goals for Chelatna have always been met or exceeded, Judd was below goal in a single year, and Larson missed three goals by less than 20% (Munro, 2019). Escapements to these index lakes by themselves do not suggest a concern for conservation of Susitna fish. Other Lakes, such as Shell, once estimated to account for 10% of Susitna drainage sockeye production, have been severely impacted by pike predation and Beaver dams, and produce far fewer sockeye than in the past (Shields and Frothingham, 2018).

If management actions were taken to reduce harvest of Susitna bound sockeye in KMA, it is important to consider the fate of these “savings” and how we could evaluate effects of these actions. Any incidental harvest of Cook Inlet stocks avoided in KMA fisheries would be subject to a variety of harvest and natural mortalities before reaching spawning grounds, as they pass through fisheries in Lower and Upper Cook Inlet. Recent estimates of harvest rates on Susitna origin sockeye in Upper Cook Inlet fisheries range widely, but average 38%, 2006-2015

(Erickson, 2017, ADF&G report to Board of Fisheries). A large proportion of these fish would be harvested in Cook Inlet fisheries before reaching their natal streams and lakes.

Importantly, impacts of Susitna bound sockeye harvest in KMA on annual Susitna runs probably cannot be measured with confidence for two reasons. First, Shedd et al. (2017) used a genetic baseline that includes populations throughout the Susitna/Yentna drainage but does not distinguish fish which may be destined for Judd, Chelatna and Larson Lakes. The lake stocks can be justified as a separate JCL reporting group in Cook Inlet genetic studies (Barclay, 2018). As a result, the relationship between KMA harvest of Susitna reporting group and goals established to index Susitna escapement is unknown because KMA harvests of Susitna stocks cannot be attributed to any of these lakes.

Also, recent mark recapture studies suggest large uncertainties with estimating drainage wide escapements to Susitna drainage (Yanusz et al., 2007). Results from 2006-2008 studies revealed wide 95% confidence intervals (2006, 335,448 - 500,946; 2007, 292,867 - 362,597; 2008, 320,763 - 398,317) for escapements of sockeye to Yenta and Susitna Rivers combined (Erickson, ADFG report to Board of Fisheries). The highest estimated catch for Susitna fish in any KMA stratum, without accounting for additional harvest and predation in Cook Inlet, falls within those confidence intervals. It is unlikely that effects of reducing harvest of Susitna fish in KMA could be detected in Susitna run estimates.

In 2014-2016, estimated harvest of Susitna fish in Upper Cook Inlet fisheries was 3 fold to more than 40 fold greater than in KMA (Barclay, 2018, Shedd et al., 2016). Attempts to conserve Susitna fish must primarily

include Cook Inlet fisheries, where savings are more efficiently realized and can be measured.

Cape Igvak

The management plan for Cape Igvak has been in place since 1978. The Cape Igvak fishery is one of only two areas in the state (the other is Southeast District Mainland) in which harvest and escapement triggers from an adjacent management area (both Area L-Chignik) must be met before the fishery can open. For this study, no Igvak samples were taken in 2014 because low Chignik harvest numbers kept the area closed to commercial harvest. In 2015, only the July stratum (middle) was sampled as Igvak was again closed at first due to inadequate harvests in Chignik. Harvest of Chignik fish in Igvak was estimated as 2,059 fish. In both 2014 and 2015, the management plan had its intended effect of keeping Igvak closed or limited when Chignik harvests were low. In 2016, with a stronger Chignik run, an estimated 114,412 Chignik sockeye were harvested in the early (June) stratum. A little more than 10,006 Chignik fish were harvested in July. With only three temporal strata sampled over a three year period, there is no new information on harvest patterns of Chignik fish at Igvak that would support changes to the management plan. While it is clear that some Chignik fish are captured at Igvak (which is reason for the management plan), one data point an order of magnitude greater than the other two reveals dramatic swings in non-local stock abundance. There is no data in this study that supports the presumption in the management plan that 90% of sockeye salmon harvests in Igvak are Chignik bound fish.

Management Plans

The management of KMA fisheries is guided by a number of management plans including the Westside Management plan (5AAC 18.362) and the Alitak District Management plan (5AAC 18.361), most relevant to this genetics study. While each has very specific management direction for date ranges and particular areas, the central theme is prosecution of traditional fisheries to sustainably harvest early and late runs of sockeye salmon to Karluk, Ayakulik, Upper Station and Frazer Rivers, as well as harvest pink, chum and coho salmon to a variety of locations in July, August and September. The plans have an odd year emphasis for pink salmon management as these are typically larger than even year runs in KMA.

From a biological perspective, successful fisheries management in Alaska is measured through achievement of escapement goals. The Alaska Board of Fisheries pays careful attention to escapement goal performance as a yardstick for sustainable management. For Karluk early sockeye, goals have been achieved or exceeded every year since 2012, and for the late run, since 2010. For early and late sockeye runs to Ayakulik , goals have been achieved every year since 2010. For early Upper Station stock, goals were achieved in 2017 and 2018 and for late Upper Station, goals have been met every year since 2010. For Frazer Lake sockeye, goals have been met every year since 2010. Odd year pink salmon goals in the Kodiak Archipelago have been met or exceeded every year since 2011 (Munro, 2019). Recognizing that scientifically defensible escapement goals are foundational for maximizing yields in future years, it seems clear that

KMA fisheries management has been successful and that these management plans are working well.

Literature Cited

Anderson, T .J., J. Jackson, B. A. Fuerst, and A. E. Dorner. 2019. Kodiak Management Area commercial salmon fishery annual management report, 2018. Alaska Department of Fish and Game, Fishery Management Report No. 19-17, Anchorage.

Barclay, A. W. 2019. Genetic stock identification of Upper Cook Inlet sockeye salmon harvest, 2015-2018. Alaska Department of Fish and Game, Regional Information Report 5J19-02, Juneau.

Barclay, A. W., C. Habicht, W. Gist, and T. M. Willette. 2017. Genetic stock identification of Upper Cook Inlet coho salmon harvest, 2013-2015. Alaska Department of Fish and Game, Regional Information Report 5J17-03, Anchorage.

Brennan et al., 2017

Dann, T. H., C. Habicht, S. D. R. Olive, H. L. Liller, E. K. C. Fox, J. R. Jasper, A. R. Munro, M. J. Witteveen, T. T. Baker, K. G. Howard, E. C. Volk and W. D. Templin. 2012. Stock composition of sockeye salmon harvests in fisheries of the Western Alaska Salmon Stock Identification Program (WASSIP), 2006-2008. Alaska Department of Fish and Game, Special Publication No. 12-22, Anchorage.

Erickson, J. (2017) Review of Susitna River sockeye salmon stock status. Oral report to the Alaska Board of Fisheries.

Fair, L. F., T. M. Willette, and J. Erickson. 2009. Escapement goal review for Susitna River sockeye salmon, 2009. Alaska Department of Fish and Game, Fishery Manuscript Series No. 09-01, Anchorage.

Foster, M. B., and T. H. Dann. 2014. Genetic stock composition of sockeye salmon harvested in commercial salmon fisheries of Kodiak Management Area, 2014. Alaska Department of Fish and Game, Regional Operational Plan ROP.CF.4K.2014.24, Kodiak.

Foster, M. B., and T. H. Dann. 2015. Genetic stock composition of sockeye salmon harvested in commercial salmon fisheries of the Kodiak Management Area, 2015-2016. Alaska Department of Fish and Game, Regional Operational Plan No. ROP.CF.4K.2015.15, Kodiak.

Habicht, C., A. R. Munro, T. H. Dann, D. M. Eggers, W. D. Templin, M. J. Witteveen, T. T. Baker, K. G. Howard, J. R. Jasper, S. D. R. Olive, H. L. Liller, E. L. Chenoweth and E. C. Volk. 2012. Harvest and harvest rates of sockeye salmon stocks in fisheries of the

Western Alaska Salmon Stock Identification Program (WASSIP), 2006-2008. Alaska Department of Fish and Game, Special Publication No. 12-24, Anchorage.

Munro, A. R. 2019. Summary of Pacific salmon escapement goals in Alaska with a review of escapements from 2010 to 2018. Alaska Department of Fish and Game, Fishery Manuscript Series No. 19-05, Anchorage.

Shedd, K. R., M. B. Foster, T. H. Dann, H. A. Hoyt, M. L. Wattum, and C. Habicht. 2016. Genetic stock composition of the commercial harvest of sockeye salmon in Kodiak management area, 2014?2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-10, Anchorage.

Shedd, K. R., M. B. Foster, and C. Habicht. 2017. Addendum to FMS 16-10: Redefinition of reporting groups to separate Cook Inlet into four groups for the genetic stock composition of the commercial harvest of sockeye salmon in Kodiak Management Area, 2014?2016. Alaska Department of Fish and Game, Fishery Manuscript No. 17-07, Anchorage.

Shedd, K. R., T. H. Dann, H. A. Hoyt, M. B. Foster, and C. Habicht. 2016. Genetic baseline of North American sockeye salmon for mixed stock analyses of Kodiak Management Area commercial fisheries, 2014-2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-03, Anchorage.

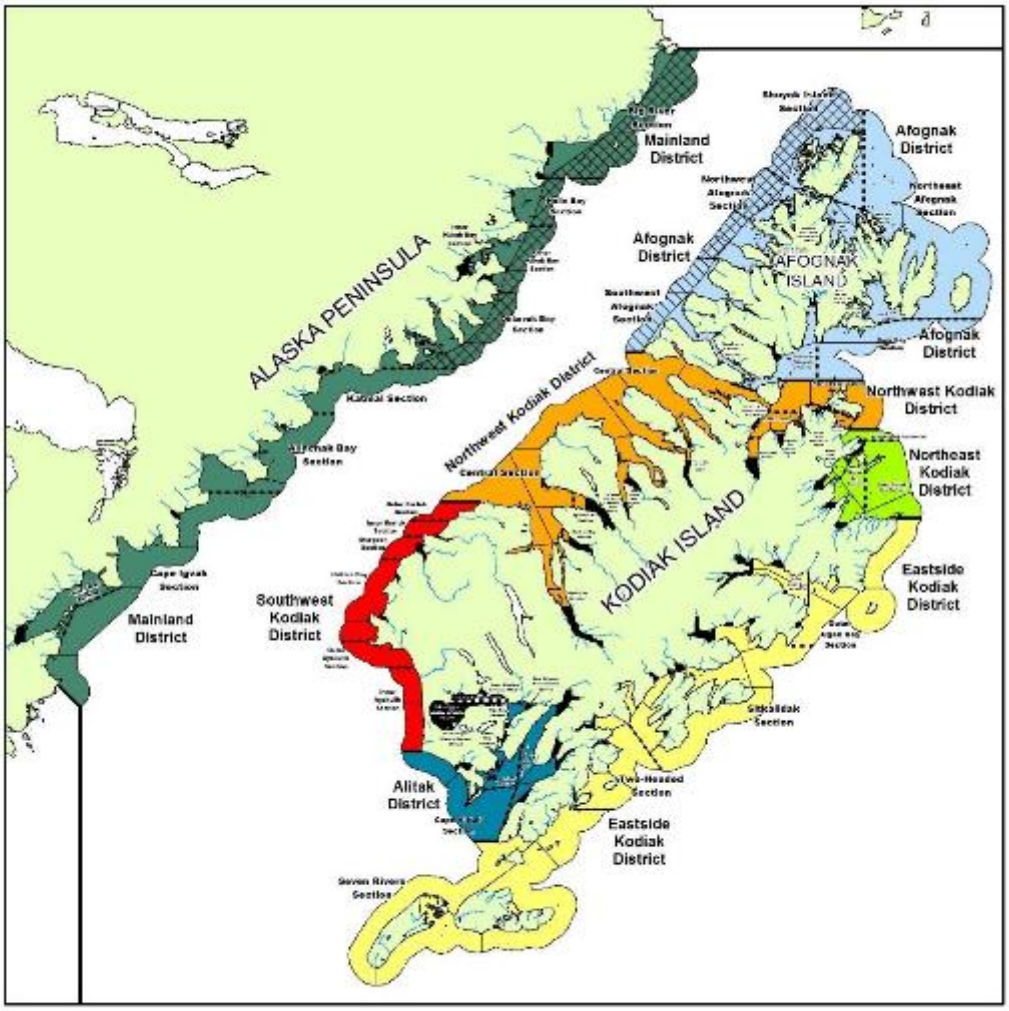
Shedd, K. R., T. H. Dann, M. B. Foster, and C. Habicht. 2016. Addendum to FMS 16-03: Redefinition of reporting groups by combining Ayakulik and Frazer into one group for the genetic baseline of North American sockeye salmon for mixed stock analyses of Kodiak Management Area commercial fisheries, 2014-2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-05, Anchorage.

Shields, P., and A. Dupuis. 2015. Upper Cook Inlet commercial fisheries annual management report, 2014. Alaska Department of Fish and Game, Fishery Management Report No. 15-20, Anchorage.

Shields, P., and A. Dupuis. 2017. Upper Cook Inlet commercial fisheries annual management report, 2016. Alaska Department of Fish and Game, Fishery Management Report No. 17-05, Anchorage.

Shields, P., and A. Frothingham. 2018. Upper Cook Inlet commercial fisheries annual management report, 2017. Alaska Department of Fish and Game, Fishery Management Report No. 18-10, Anchorage.

Yanusz, R. J., R. A. Merizon, T. M. Willette, D. G. Evans and T. R. Spencer. 2011. Inriver abundance and distribution of spawning Susitna River sockeye salmon Oncorhynchus nerka, 2008. Alaska Department of Fish and Game, Fishery Data Series No. 11-12 Anchorage.



Review of Shedd et al. (2016): *Genetic Stock Composition of the Commercial Harvest of Sockeye Salmon in Kodiak Management Area, 2014-2016*

Report to the Kodiak Salmon Workgroup

Harold J. Geiger
Terrance J. Quinn II

September 11, 2017

Executive Summary

The Kodiak Salmon Workgroup contracted us[1] to provide a scientific review of the report by Shedd et al. (2016) entitled *Genetic Stock Composition of the Commercial Harvest of Sockeye Salmon in Kodiak Management Area, 2014-2016*. This review consists of an examination of the scientific merit of the study, its utility compared to previous studies, an interpretation of how the results should be viewed in terms of the magnitude of interceptions of Cook Inlet sockeye salmon in the Kodiak Management Area's commercial fisheries, and thoughts about further investigations that may shed additional insight into Kodiak and Cook Inlet stock compositions of sockeye salmon.

Our primary findings:

1. From the point of view of fishery policy, the most important statistic is the *stock-specific harvest rate*, which is not reported in the Shedd et al. (2016) document for stocks outside the Kodiak Management Area. What is reported is the *stock-specific contribution rate*. Stock composition estimates represent the proportions of a catch that was made by various stocks in a particular spatial and temporal stratum or groups of strata. In contrast, the harvest rate describes the proportion of an annual return that was harvested in a fishery or group of fisheries. Consequently, a fishery may show a large contribution rate for a stock, but the total effect on that stock may be quite small. We illustrate this phenomenon below.
2. The new genetic stock composition approach used in this study is superior to other approaches used in the past, because the real stock composition is estimated rather than inferred from less reliable measurements (e.g., length composition). The use of a Bayesian modeling approach to estimate stock composition is state-of-the-art and allows for the appropriate treatment of random variability due to both random error caused by sampling the fishery mixture and also from the sampling of the contributing stocks.
3. The stratified sampling design used is appropriate with respect to accuracy and precision of stock composition (relative and absolute). It is clear that the authors devoted substantial attention to implementing the sampling design with the intent of obtaining a random or representative sample within combinations of major regional and temporal strata. Further information would be desirable about how the implementation was conducted on finer spatial and temporal scales to justify the assumption of a random or representative sample. For example, how was an individual fish selected for genetic sampling and were there protocols established to prevent selecting fish with particular physical characteristics, such as size?
4. Similar to past studies, results from the study revealed substantial variability in stock composition across years, among spatial strata, and among temporal strata. Further study may be desirable to determine if there are consistent patterns in this variability across years, spatial strata, and temporal strata. Continued genetic sampling and analysis in the future would thus be desirable.

Introduction and Overview

We were asked to provide a scientific review of the Shedd et al. (2016) titled *Genetic Stock Composition of the Commercial Harvest of Sockeye Salmon in Kodiak Management Area*. This

[1] See brief biographical statement in Appendix A

complex 154-page report describes an extensive genetic analysis followed by a statistical analysis of the genetic data for Kodiak area fisheries in catch years 2014, 2015, and 2016. The principal genetic tools that were used for this study were the single nucleotide polymorphism, or SNP, approach. Here we will comment on scientific criticisms of the study that appear relevant, we will briefly comment on the various methods and techniques that were used, and we will offer a broad assessment of the significance of the major findings. As we will explain in more detail below, the study appears to have been carefully conducted and the numerical estimates appear to be well crafted and reliable.

The Alaska Department of Fish and Game had previously tried to use scale pattern analysis and an analysis of fish size to estimate the proportion of non-local stocks in the Kodiak Management Area. For various technical reasons neither of these techniques were very successful. In one of the last reports on the attempts to use fish size for this purpose, Vining (1996) wrote, "As the 1995 analysis indicates, this methodology continues to generate only rough estimates, some with little confidence." It is the opinion of Vining that "other techniques, such as genetic stock identification, tagging or scale pattern analysis should be evaluated for use in the future, if more precise estimates of stock composition for sockeye salmon caught within the [Kodiak Management Area] are desired." This leads us to the present genetic study by Shedd et al. (2016).

The genetic analysis of stock mixtures rests on several assumptions. The analysis starts with the definition of a *catch mixture*, because the catch is presumably made up of a mix of stocks. Importantly, the number of contributing stocks must be known, they all must be sampled, and the genetic character of each stock must be established. Next, a representative sample of the catch mixture must be drawn and the genetic character of each specimen in the catch sample must also be established. Finally, a complicated statistical algorithm can then be used to produce an estimate of the proportion of each of the stocks in the mixture by comparing the genetic characterizations of each fish in the catch mixture to the previously established genetic characterization of the contributing stocks.

A complete analysis must include a study of both the accuracy and the precision of the estimates. In this context, *accuracy* refers to the absence of any statistical bias or other kinds of systematic errors that would consistently cause specific stock estimates to be too high or low. Here *precision* refers to errors that are caused by using only a sample from the stock of origin and the catch mixture, rather than an examination of every single fish in the fishery and every single fish in the spawning stocks. Generally, accuracy is harder to study, detect, and control, while precision can generally be controlled by increasing the sample size. Also, precision is usually studied by looking at the variation from one specimen to another in the samples. Precision measures are usually offered in the form of confidence intervals, standard errors, or coefficients of variations.

Sampling Design

The goal of the study by Shedd et al. (2016) is to determine stock compositions of sockeye salmon within the Kodiak Management Area. Consequently, sampling was restricted to the Kodiak Management Area, rather than to the overall range of sockeye salmon in the western Gulf of Alaska. The authors defined six Kodiak spatial strata of interest (called subregional sampling groups) for *sampling* genetic tissues, comprised of (1) Uganik-Kupreanof, (2) Uyak, (3) Karluk-Sturgeon, (4) Ayakulik-Halibut Bay, (5) Alitak, and (6) Igvak. The first five are located around Kodiak Island, while Igvak is part of the mainland district. The Chignik

regional reporting group had combined estimates from subregions Black Lake and Chignik Lake. Four other regional spatial strata outside of Kodiak and Chignik were West of Chignik, Cook Inlet, Prince William Sound, and South of Cape Suckling. The report did not contain justification for this particular choice of spatial strata, but suggests that considerations included areas with active management and those that are used in run reconstructions to aid management.

One confusing area is that several spatial scales are referred to in the report. For *reporting* purposes (instead of *sampling*), there are a total of 14 subregional *reporting groups* listed on page 2 that constitute the entire western Alaska area. The report designates ten of these groups as *subregional reporting groups* within the Kodiak (8 subregions) or Chignik (2 subregions) *regional reporting groups*. Six regional reporting groups including those outside of Kodiak and Chignik are listed in the tables, with subregional breakdowns for the 8 Kodiak subregions and the 2 Chignik subregions. In the end the system does seem to be consistent; however, we recommend a simpler and clearer description of spatial divisions. *These definitions of spatial strata must be understood to understand the tables and figures of results, which include both regional reporting groups and subregional reporting groups.*

The report indicates that temporal strata are also considered in combination with the spatial subregional strata: Early, Middle, and Late (see page 3 in the Shedd et al. (2016) report. The temporal strata are consistent with patterns that have been observed in past studies.

The sample size goal was to extract 380 tissue samples from each time-area stratum; no reference was provided for this number. The sampling within temporal strata was intended to be proportional to daily abundance. When this was not possible, the total sample size was obtained by sampling days with sufficient additional samples at random until the total of 380 was achieved, a reasonable approach.

We could not determine if sampling was representative within spatial strata, although the intent of the authors appears to be sampling proportional to harvest, a reasonable goal. It would be helpful to have a brief description elaborating the protocol used to achieve this goal.

The sampling design most appropriate for multiple strata with high variation among strata, to obtain high precision and accuracy, is stratified random sampling (Thompson 2016). In the future it would be desirable to show that high variation is present and the improvement in precision by using stratification over simple random sampling. One advantage to using a proportional allocation of sample size with respect to within stratum variation is that different choices for strata are not likely to produce inaccurate estimates. Nevertheless, it is not necessary to use proportional sampling to justify the use of stratified sampling in terms of accuracy, as long as a representative sample is obtained within each stratum. In particular, the use of a fixed sample size of 380 for all spatio-temporal strata is completely acceptable. (Although it may not be the most efficient allocation scheme, it does not induce estimation bias.)

The use of stratified random sampling also has a desirable product in that both relative and absolute stock compositions can be estimated both for individual strata and for combinations of strata, including that portion of the entire Kodiak Management Area that was sampled (not every single fishery was sampled). The main reason for this ability is that catches are known for all spatio-temporal strata. This is one fundamental principle that

makes estimation across strata intuitive, accurate, and precise, because relative stock compositions are projected to the total catch to get absolute stock compositions by strata that can then simply be summed across a set of strata of interest.

An additional feature of the sampling design is a set of data quality control procedures regarding the genetic data to avoid the inclusion of erroneous data into the analysis (pages 8–9). Thus, we were unable to uncover any appreciable flaws in sampling, genetic data processing, or genetic analyses in the study.

In summary, we believe that the overall sampling design of using stratified random sampling is appropriate for the genetic analysis of estimating stock composition of sockeye salmon in the Kodiak Management Area. Further studies should be done to consider alternative stratification choices both within space and time and to justify the sample size goal of 380 samples per stratum.

Policy Issues and Stated Goals for the Study

In the introduction of the Shedd et al. (2016) report, the reader finds that the stated purpose of the study was to "sample the major sockeye salmon commercial fisheries in marine waters of [the Kodiak Management Area] from June through the end of August and use genetic mixed stock analysis (MSA) to estimate stock compositions and stock-specific harvests." Later in the report, the reader finds this statement about the goal of the project: "The overall goal of this project is to provide information that will be useful for reconstructing runs, building accurate brood tables to define escapement goals, and refining management by identifying spatial and temporal harvest patterns of *local* and *nonlocal* stocks (emphasis in the original)." Later, the reader finds four stated objectives, including "report [genetic mixed stock analysis] results of stock-specific harvests of sockeye salmon sampled from *selected* commercial fisheries in [the Kodiak Management Area], 2014—2016 (emphasis added)," and "characterize where stocks were harvested from *select* commercial fisheries (again, emphasis added)." This report did not have the express purpose of making arguments regarding allocation decisions by the Alaska Board of Fisheries.

Regardless, the study does conclusively demonstrate that sockeye salmon bound for Cook Inlet were caught in some times and in some areas in the fishing years studied. In the case of the Kodiak Area, there really was no reason to believe that the commercial harvest was made up of only single stocks that originated in the Kodiak Management Area. That is, a finding of rich stock mixtures in at least some times and areas should not have been surprising. There have been many long-standing questions about the degree to which stocks are mixed in the Kodiak Management Area. Summarizing historical tagging studies, Barrett and Swanton (1991) report that sockeye harvests in the North Shelikof Strait in the 1940s, 1970s, and 1980s ranged from 30% to 100% Kodiak fish and 0% to 59% Cook Inlet-origin fish. Moreover, Barrett and Swanton concluded there were large numbers of Cook Inlet bound fish in the North Shelikof Strait fishery in July of 1990.

Contribution Rate Versus Harvest Rate

There are two important rates or proportions that can be derived from stock composition analysis and discussed before policy-making bodies, such as the Alaska Board of Fisheries:

the *contribution rate* and the *harvest rate*. These two statistics have very different significance to management. These two rates have often been confused in conversations among fishermen, in testimony before the Alaska Board of Fisheries, and in conversations with members of the press. The percentage that each stock makes up in a mixture of stocks is called the *contribution rate* (or sometimes the *stock proportion*). For example a fishery may have harvested 50 fish, and 40 of those fish might be from Stock A, with 10 fish from Stock B. Then the *contribution rate* of Stock A is 80%=(40/50)100%. For the purposes of management that could be either high or low. But if the contribution rate was 80%, then this does *not* mean that 80% of the stock was harvested; a harvest rate can be estimated only with abundance or run-size information for the stock of interest.

A large number for the contribution rate is not necessarily important to management, but it could be. If the original size of Stock A was 10,000 fish before this harvest, then the *harvest rate* on Stock A in the catch mixture would be 40/10,000 = 0.4%—which may be considered insignificant. Alternatively, if the original size of stock A was only 150 fish before the harvest, then the harvest rate would be 40/ 250 = 27%—which would usually be considered significant from a management perspective. Although moderate-to-large contribution rate statistics can lead to misplaced anxiety or even outrage, the most important statistic for management policy is the harvest rate, which is the rate that is most clearly related to the population dynamics of a stock.

Technical Comments on Bayesian Analysis and Uncertainty Measures

The statistical analysis was carried out using the Bayesian method of Pella and Masuda (2001). We contend that this method is a reasonable approach with several advantages over the more traditional *maximum likelihood* approach. As this is a Bayesian approach, there are some differences between the interpretations of the measurements that may be confusing and unnecessarily tedious to some readers of the Shedd et al. (2016) report. In the method of Pella and Masuda (2001), the unknown contribution rates (or stock mixing proportions, as they call them) are treated as unknown random variables rather than constant and unknown parameters in the maximum likelihood approach. The analysis proceeds by simulating the probability distributions of these random quantities, with the genetic data used to help develop these distributions.

In a Bayesian analysis, uncertainty in stock contribution rates is frequently displayed by the use of *credible intervals* rather than *confidence intervals*. For example, in Table 3 of the Shedd et al. (2016) report, for the Kodiak reporting group the 90% credible interval runs from 80.9% to 88.1%. The correct interpretation of this interval is that given all of the stated assumptions, *the probability is* 90% that the true value is found between 80.9% and 88.1%, given a list of assumptions. Many people, incorrectly, think this is exactly what a 90% confidence interval is, but this is a mistake for some technical, statistical reasons. For the purposes of readers of this report, we note that the Bayesian results will often closely approximate the more traditional results (Pella and Masuda 2001), so that there should be no harm in simply interpreting the Shedd et al. (2016) credible intervals as the more familiar 90% confidence intervals to investigate uncertainty in the stock composition estimates. While every one of the assumptions that underpin the analysis is probably not strictly true, these intervals do seem to be a very reasonable guide to the precision in the estimates. Based on the reported credible intervals and based on the assumptions stated in the report,

the Shedd et al. (2016) estimates appear to be both accurate and precise enough for the purposes of the study.

The Results

In trying to understand the results of the analysis, readers of the Shedd et al. (2016) report may find Figures 8 through 19 helpful, especially when paired with the maps provided in Figures 1–7. Figures 8, 10, 12, etc. (the even-numbered figures) show the estimated contribution rates (or stock mixing rates) for stocks using two levels of detail for the authors' *subregional* and *regional reporting groups* mentioned above. These estimates are then reported by specific time-area catch strata. At the highest level of aggregation there are six regional reporting groups, or what might be considered stocks in the broadest sense: (1) West of Chignik, (2) Chignik, (3) Kodiak, (4) Cook Inlet, (5) Prince William Sound, and (6) South of Cape Suckling. These groups may be the most useful for discussions about fishery management policy. Additionally there are estimates for 10 specific subregional reporting groups, or what might be considered stocks in a more narrow sense, in the Westward Region, and these estimates may be more useful for actual managers or to look at the reasonableness of some of the estimates. Similarly, the odd-numbered figures (Figures 9, 11, 13, etc. in Shedd et al. (2016)) have the stock contribution rates re-expressed as the stock-specific *number of fish harvested* (compared to rates in the previously mentioned figures) in the mixtures.

The usual pattern in these figures is that the majority of the fish harvested in each time-area grouping originated in the Kodiak management area. There are some notable exceptions, especially in 2015. For example, in the Ayakulik-Halibut Bay area, a large fraction of the fish were classified to be of Cook Inlet origin, especially in 2015 during the July 4 to August 1 period (Figure 14 in the report by Shedd et al. (2016)). When viewed in terms of numbers of fish, rather than proportions, the effect looks even stronger (Figure 15). In the Alitak district the catches of fish classified to Cook Inlet exceed the number of fish classified to the Kodiak area in two years: 2015 and 2016. Here too, the effect looks even stronger when views as the number of fish harvested 2015 (Figure 17). However, when summing over time and area, in all study years fish of Kodiak area origin dominate the catch, although catches of Cook Inlet-origin fish increased in 2015, and to a lesser extent, remained high in 2016, when compared to 2014 (Figure 20 in Shedd et al. (2016)).

Questions about why the harvest of Cook Inlet fish might be higher or lower in specific times or areas are beyond the scope of this review. One obvious question is could this variation in the proportion of Cook Inlet-origin fish be due to variation in the sizes of sockeye salmon runs in Cook Inlet?

To get at this question we simply ignored Lower Cook Inlet and brought together run size estimates for Upper Cook Inlet (Alaska Department of Fish and Game, retrieved August 17, 2017), together with the Shedd et al. (2016) estimates of the harvest of Cook Inlet bound fish in the Kodiak Management Area (taken by eye from Figure 20 or from Tables 67–69). As a point of reference, Stopha (2017) projected that approximately 0.3 million sockeye salmon would be returning to hatcheries in Lower Cook Inlet 2017. We assume that the times and areas sampled by Shedd et al. (2016) represent areas where interceptions of Cook Inlet fish would have been considered to be most likely, although we do not know that is true. Here again, as a point of reference, the total fish accounted for by the six Regional Reporting

Groups in Tables 67–69 was about 50%–60% of the total reported harvest for the Kodiak Management Area for the three study years (catch numbers from Munro 2015 and later reports in this series). Even though not all times and areas in Kodiak Management Area were sampled and even though there was some sockeye salmon production in Lower Cook Inlet, we expect that the Shedd et al. sockeye salmon catch estimates of Cook Inlet bound fish caught in the Kodiak Management Area divided by the estimated Upper Cook Inlet run size to provide a crudely reasonable—even if slightly too low—approximation to the harvest rate on Cook Inlet-origin fish harvested in the Kodiak Management Area (Table 1).

Although there are only three years available for comparison, it does not appear that changes in run size explain the difference in harvest rates on the Cook Inlet stocks. The highest harvest rate on Cook Inlet stocks was in 2015, the year with the highest in-Inlet run size among the three study years, but the second highest harvest rate is on the year with the lowest run size (Table 1 below).

Table 1. Upper Cook Inlet run size in millions of sockeye salmon **(A)** (from ADF&G), the estimated harvest of Cook Inlet-origin sockeye salmon caught in the Kodiak Management area in millions of fish **(B)** (From 67–69 in the Shedd et al. (2016) report), and the approximate harvest rate (estimated harvest in the Kodiak Management Area divided by the in-Inlet run size plus the harvest in the Kodiak Management Area) on Cook Inlet-origin sockeye salmon in the Kodiak Management Area **(C)**.

	(A) Cook Inlet run size	**(B)** Cook Inlet catch in KMA	**(C)** Approximate harvest rate
Year	(millions)	(millions)	in KMA
2010	5.71		
2011	8.68		
2012	6.46		
2013	5.74		
2014	5.54	0.1	2%
2015	6.29	0.6	9%
2016	5.04	0.4	7%

Another important question: were the harvests of Cook Inlet-bound sockeye salmon excessive? Though this is a policy judgment, rather than a scientific question, we note that in the years 2014-2016, the estimated *harvest rate* ranged from 2% to 9%, and did not reach or exceed 10% in any year in the study (Table 1). Some might point out that the way we calculated the harvest rate under-represents its true magnitude—and the estimates in Table 1 very well may be too low. Even so, it would be highly unlikely we have underestimated it by a factor of 2, meaning that the median harvest rate over the three study years would have been almost surely less than 15%, and probably considerably less.

Are there areas where the proportion or numbers of Cook Inlet-origin sockeye salmon are higher than in other areas? Figures 22, 23, and 24 in the Shedd et al. (2016) report are useful for speculating about this question—although it is really impossible to establish a trend with only three years of data. Notice that the area with the highest number of Cook Inlet-origin fish was Ayakulik-Halibut Bay in 2014 and again in 2015. However, in 2016 the number of Cook Inlet-origin fish in this district was much reduced from the previous year, and a larger number of Cook Inlet-bound sockeye salmon was caught in the Igvak area—which had previously been an area with very few Cook Inlet-origin fish harvested.

When time is brought into the discussion the situation also appears murky. The proportion of Cook Inlet-origin fish caught in the Uyak area is relatively low in all sampling periods in 2014 (Tables 15, 16, and 17 in the Shedd et al. (2016) report, yet the proportion rises to relatively high levels (54% and 32%) in the second and third sampling periods in 2015 (Tables 20 and 21). Then in 2016, the proportion was much reduced, with over 80% of the fish harvested in each period in this catch area belonging to the Kodiak reporting group (Tables 23, 24, and 25). This observed variation shows the danger in looking at just three years and thinking that one sees a trend. Further sampling and study is warranted to understand patterns of temporal variation.

The proportion of Cook Inlet-origin fish in the Ayakulik-Halibut Bay area is relatively low (less than 8%) in the first sampling period (June 1 to June 27) in 2014, but that this rises to 24% in the second period (June28 – July 25) of that year, and then falls to about 5% in the last sampling period of that year (Tables 39, 40, and 41). However, in the next year this proportion starts high in the first period (28%), rises to 48% in the second period, and then drops to less than 10% in the last period (Tables 43, 44, and 45). In 2016, the first period contains essentially all fish originating from the Kodiak Management Area (>99%; Table 47), but the proportion of Cook Inlet-origin fish again rises in the second period to nearly 42%, and remains high at 28% in the third period (Tables 47, 48, and 49). A person focusing on the similarities would note that the second sampling period for this district was consistently high in all three sampled years, and that is correct. However, someone focusing on the large year-to-year variation in the proportion of Cook Inlet-origin fish would correctly point out that with three data points it is premature to speculate that this pattern will continue into the future.

Final Comments

The Shedd et al. (2016) report is generally well written, organized, and it offers a reasonable amount of specific details about the actual genetic and statistical analyses. While it is impossible to judge the care, attention to detail, and technical skill that actually went into actual genetic analysis from the written page, the report demonstrates a great deal of

technical sophistication. The sections on "Laboratory Quality Control" appears to demonstrate that the authors did take reasonable care to detect and report on obvious mistakes. The Alaska Department of Fish and Game's Gene Conservation Lab has an excellent reputation for this kind of work. It would be extremely surprising to find that many, if any, outright mistakes were made in either the genetic or the statistical analyses.

The estimates in the Shedd et al. (2016) report seem quite reasonable. Catches were generally dominated by fish that originated within the Kodiak Management Area. Although there are some exceptions, a finer-scale examination shows catches were generally dominated by stocks that originated near the area of harvest. The Shedd et al. (2016) report is technically sophisticated and it contains features that we have found are indicative of a study that is carefully conducted. We found no reason to think that there were any large inaccuracies in the study, and the reported measures of precision provide evidence that the reported estimates are trustworthy and suitable for their intended purposes.

Finally, we note that the estimated harvest rate on Cook Inlet-bound sockeye salmon were below 10% in each year, and substantially below 10% in one year. These harvest rates generally agree with what previous, less accurate studies, have suggested. However, with only three years of measurements, with a large fraction of the catch not sampled, and with large annual variation in those measurements (much larger than the error obtained from the credible intervals), it is very hard to conclude that these results bracket the range of what to expect if the study were to be repeated, or to conclude that these results represent what would happen in a "typical year" (if there ever is such a thing). We recommend that the genetic analyses in this study be conducted to better understand the apparently real variation in stock contribution estimates (both rates and harvests).

These estimates in Shedd et al. would have been more useful for policy discussions if they could be recast in terms of harvest rate rather than contribution rate. In fairness, we note that this was not one of the stated goals for the study, but this appears to be a subject that needs to be addressed in the future. We have tried to crudely approximate the harvest rate using information that was easily accessible to us. While our specific harvest rate estimates can be easily criticized, it is clear that the harvest rate was probably much less than 10% in most study years and almost surely less than about 15% in each year of the study. In the future, we recommend sampling in some of the time and area strata that were not sampled in 2014–2016, or else we recommend some discussion of why specific time-area strata can be assumed to have very low contribution rates for stocks outside the Kodiak Management Area.

Acknowledgments

We thank Heather McCarty for her help in proposing this review and guidance into the scientific and management issues involved.

References

Barrett, B.M. and C.O. Swanton. 1991. Origins of sockeye salmon in the Kodiak Management Area North Shelikof Fishery, 6 July through 25 July, 1990. Regional Information Report 4K91-3. Alaska Department of Fish and Game, Kodiak, Alaska.

Munro, A. R., editor. 2015. Run forecasts and harvest projections for 2015 Alaska salmon fisheries and review of the 2014 season. Alaska Department of Fish and Game, Special Publication No. 15-04, Anchorage.

Pella, J. and M. Masuda. 2001. Bayesian methods for analysis of stock mixtures from genetic characters. Fishery Bulletin 99:151–167.

Stopha, M. 2017. Alaska fisheries enhancement annual report 2016. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J17-04, Anchorage.

Vining, I. 1996. The use of average weight to estimate the level of harvest of non-local sockeye salmon within the Kodiak Management Area during July 6–25, 1983–1995. Regional Information Report 4K96-28. Alaska Department of Fish and Game, Kodiak, Alaska.

Appendix A – Biographical Statements for the Authors

Harold J. Geiger is the chief scientist for the St. Hubert Research Group, a small consulting company in Juneau, Alaska. He previously worked for the Alaska Department of Fish and Game, holding several positions on the salmon research staff of the Division of Commercial Fisheries before retiring in 2007. He held the position of Chief Biometrician in the late 1990s and was the Salmon Research Supervisor for the Southeast Region in the early 2000s. He holds a Master's degree in Statistics from Oregon State University and a PhD from the College of Fisheries and Ocean Sciences at the University of Alaska Fairbanks.

Terrance J. Quinn II, Ph.D. has been Professor of Fish Population Dynamics in the Fisheries Department, College of Fisheries and Ocean Sciences, University of Alaska Fairbanks for 32 years. He obtained his Ph.D. in Biomathematics from the University of Washington in 1980. Dr. Quinn's research focuses on fish population dynamics; estimation of fish and whale abundance; sampling theory; and renewable resource management systems. He is the co-author or co-editor of 4 books and over 100 scientific publications and has shepherded about 40 students through their post-graduate careers. He has been a member of the Statistical and Scientific Committee of the North Pacific Fishery Management Council since 1986 and was a former chair of that body. He is a former member of the Ocean Studies Board of the National Academy of Sciences and served on five of their committees, including two as chair or co-chair. He is an Associate Editor of the Canadian Journal of Fisheries and Aquatic Sciences.

Appendix B: Some Comments on Stock Mixture Analysis

The earliest techniques for developing these estimates were based on simply capturing migrating salmon, tagging them with a visible tag, and then looking for the tags on spawning fish. By comparison, this is a crude technique as it is hard or even impossible to control for how much effort went into looking for tags. That is, a stock with a small contribution to the mixture could result in a large fraction of the recovered tags if, for example, there was a counting weir on the spawning stream of that stock.

A technique that is somewhat more sophisticated is based on an analysis of scale patterns, and this technique was used extensively in the 1980s and 1990s. The technique was based on the assumption that fish originating from different systems had different growth patterns,

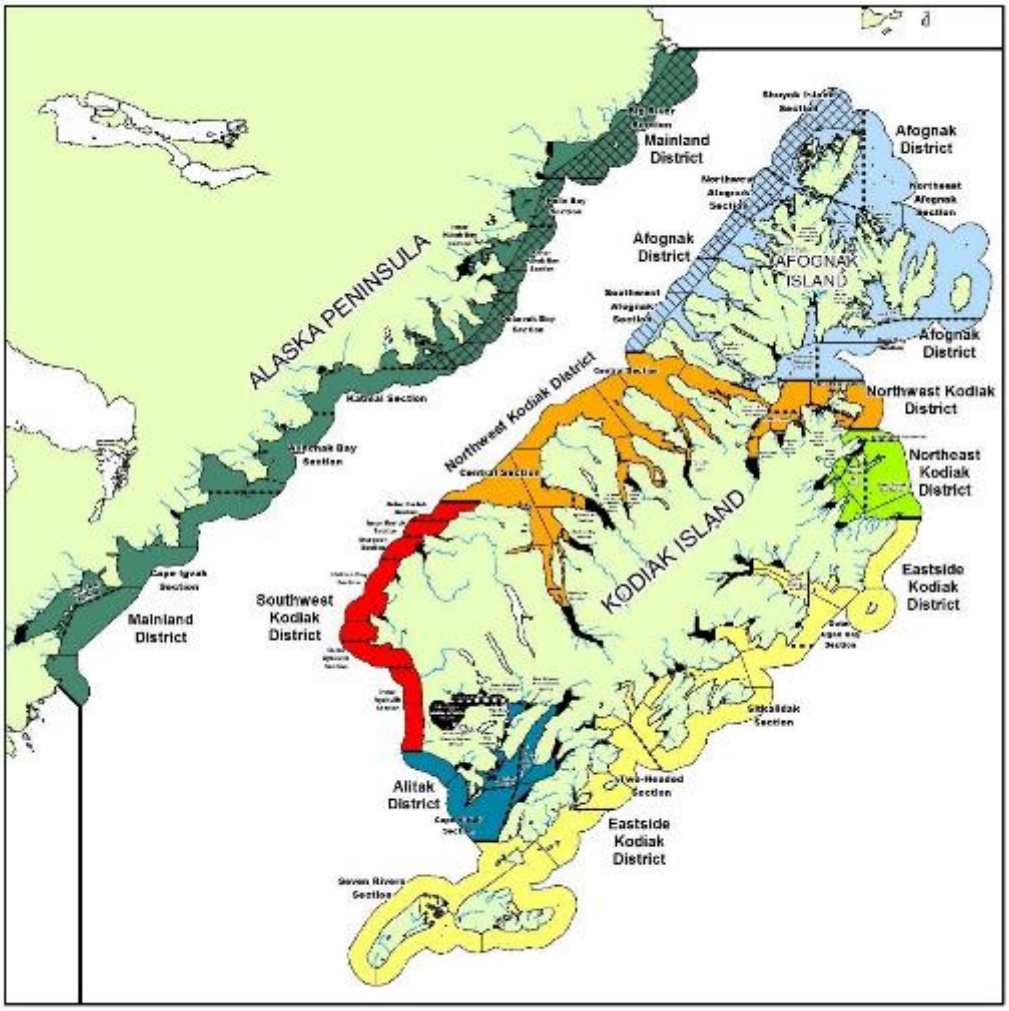
which would be represented on the scales of the fish. A large sample of scales needed to be collected for each stock, each year. Then a very large (often over 100 measurements) can be used to characterize the scale pattern for that stock, as the growing conditions that affect the scale patterns change from year to year. A complex statistical algorithm (called a linear discriminate function) is used to look for the specific measurements that show the most differences among stocks. The results from this discriminate function can then be used to classify fish in the fishery mixture to the stock that most likely produced it.

In Lynn Canal in Southeast Alaska, scale patterns were used to estimate the proportions of Chilkat and Chilkoot Lake sockeye salmon in a mixture to both actively manage a gillnet fishery during the fishing season and to study the productivity of the stocks after the fishing season. This was an ideal situation as the number of stocks was small and the patterns were quite different. As the number of stock in the mixture increased beyond just a few, or as the growing conditions among the stocks were more similar, scale pattern analysis estimates become uncontrollably imprecise, and the accuracy of the estimates would also degrade.

In the 1990s, genetic tools showed obvious advantages over other techniques. The first genetic techniques are sometimes called the allozyme techniques. Although these were time consuming and expensive, one of the main advantages was the individual stocks no longer needed to be characterized each year, as the genetic character of the stock changed slowly, if at all. Later, microsatellite techniques replaced allozyme techniques for a number of technical reasons. Finally, the SNP (Seeb et al. 2011) approach, used in this study, is usually thought of as the current state of the art and most cost-effective method of conducting a complex stock mixture analysis.

Reference

Seeb, J. E., G. Carvalho, L. Hauser, K. Naish, S. Roberts, and L.W. Seeb. 2011. Single-nucleotide polymorphism (SNP) discovery and applications of SNP genotyping in nonmodel organisms. Molecular Ecology Resources, 11: 1–8. doi:10.1111/j.1755-0998.2010.02979.x



Gulf of Alaska Climate Conditions and Sockeye Salmon Run Timing During 2014-2016

Report to the Kodiak Salmon Work Group

Michael A. Litzow, PhD

Executive Summary

During 2014-2016, staff from the Alaska Department of Fish and Game sampled sockeye salmon in Kodiak Management Area commercial catches to estimate stock-specific contribution rates to the fishery (Shedd et al. 2016). The authors of that report cautioned that "these analyses represent environmental and fishery conditions during a specific period of time…caution must be exercised when extrapolating the results to years, areas, and temporal periods not analyzed because changes in relative abundance among reporting groups, prosecution of fisheries, or migratory behavior due to ocean conditions very likely affect distribution of stock-specific harvests among fisheries" (p. 23).

The current report[2] evaluates the conditions during the years of the genetics study (2014-2016) in order to summarize how well that study may represent "typical" conditions for Gulf of Alaska sockeye runs. The specific goals of this report are to 1) review the state of ocean climate conditions during 2014-2016, 2) evaluate the evidence for effects on sockeye salmon migration and run timing during these years, and 3) summarize implications for applying the findings of the Shedd et al. (2016) genetics study as justification for making changes to sockeye salmon fisheries management in future years.

The primary findings of this work are as follows:

1. **The "Warm Blob" climate event dramatically affected ocean physics across the North Pacific during 2014-2016.** These years were characterized by unprecedented climate conditions in the Gulf of Alaska. Sea surface temperatures and air temperatures were at or beyond previously-observed maxima. River temperatures in South Central Alaska were also higher than ever observed, and river flow volumes were unusually low. Summer sea level pressure was unusually high, which led to reduced wind mixing of ocean water.
2. **Many unusual ecosystem responses were observed in the Gulf of Alaska during 2014-2016**, highlighting the strong effects that unusual climate conditions had on populations and communities at all taxonomic levels, from plankton to fish, seabirds, and marine mammals.
3. **Sockeye salmon showed unusual run timing during 2014-2016.** Catches and escapement were later than usual in many areas, both in Kodiak and Upper Cook Inlet. At the same time, some runs, such Kasilof River sockeye, were earlier than usual. Since no data on at-sea migration patterns of sockeye salmon are available for these years, these findings provide the best available information concerning sockeye salmon migration during 2014-2016, and suggest the possibility for unusual patterns of stock mixing.
4. **Unusual sockeye run timing is directly linked to unusual climate conditions.** The link between climate conditions and run timing is highly nonlinear and accelerating. In general, warmer conditions and increased atmospheric pressure during 2014-2106 were directly related to a tendency towards later overall run timing in sockeye salmon, although some runs were also unusually early.
5. **The rate of physical and biological change currently occurring in the Gulf of Alaska is unprecedented, and suggests the need for caution when re-evaluating long-standing management practices based on a few years of data.** Biological responses to climate disturbance are complex and often time-lagged. The trajectory of fisheries change in the Gulf

[2] See Appendix A – Biographical Statement

of Alaska is therefore impossible to predict, but given the size of the ongoing climate disturbance, the full range of fisheries responses has likely not yet played out. Data from 2014-2016 are likely to be a snapshot of a rapidly changing system, and given the potential impacts of physical conditions on stock mixing, are likely to quickly become outdated as unusual climate conditions continue.

Conclusion: The Gulf of Alaska is currently undergoing rapid change outside the envelope of historical conditions. In this situation, the ability of data from 2014-2016 to serve as a reliable guide for future conditions is highly questionable. These considerations are exactly in line with the caution provided by Shedd et al. (2016) concerning the use of their data in situations materially different from those under which the study took place, and suggests the need for a precautionary approach to possible management changes based on these results.

Background

Unprecedented high atmospheric pressure over large areas of the North Pacific in winter 2013-14 led to reduced wind mixing and Ekman transport, so that normal ocean cooling at the end of summer failed to occur. This event persisted into 2016, and became known as the "Warm Blob" (Bond et al. 2015). In terms of duration, size of area affected, and degree of warming involved, this event became the strongest marine heatwave ever observed globally (Di Lorenzo and Mantua 2016, Hobday et al. 2018). In the Gulf of Alaska, temperatures during 2014-2016 were by far the highest in the historical record (Fig. 1). After a hiatus in 2017, unusually warm temperatures returned in 2018-2019, and warm temperatures are expected to intensify over coming decades (Walsh et al. 2018). The best scientific understanding is therefore that the Gulf of Alaska is entering a period of persistent change.

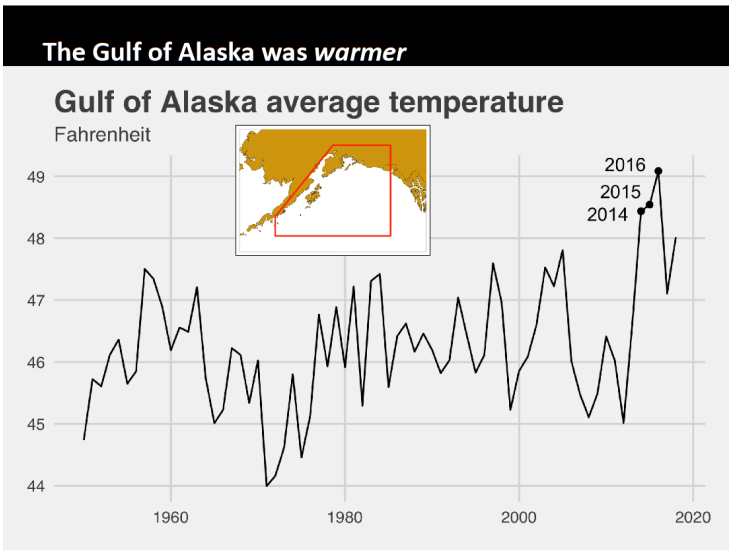


Fig. 1. Gulf of Alaska sea surface temperature (annual means), 1950-2018. Data from NOAA Extended Reconstructed SST v5.

A suite of other highly unusual climate conditions also occurred during 2014-2016 in the Gulf of Alaska. These included air temperatures and river temperatures that were at or above previous historical record high values (Fig. 2). And, in line with the high atmospheric pressure that was the immediate cause of the Warm Blob event across the North Pacific, atmospheric pressure at sea level was generally elevated over the Gulf of Alaska during 2014-2016 (Fig. 3). This high atmospheric pressure was associated with unusually weak wind mixing and wind-driven currents in the Gulf of Alaska ecosystem.

Salmon migration patterns are known to be highly sensitive to physical factors such as ocean temperature, ocean currents, river volume and river temperature (Quinn and Adams 1996, Hodgson and Quinn 2002, Hodgson et al. 2006). Sockeye runs in Cook Inlet are particularly prone to shared patterns of variability in run timing – in other words, unusual migration behavior tends to affect runs across Cook Inlet as a group (Hodgson et al 2006). Given the known sensitivity of salmon migration behavior to physical conditions, the climate event in the Gulf of Alaska has important potential implications for changing patterns of stock mixing in sockeye salmon.

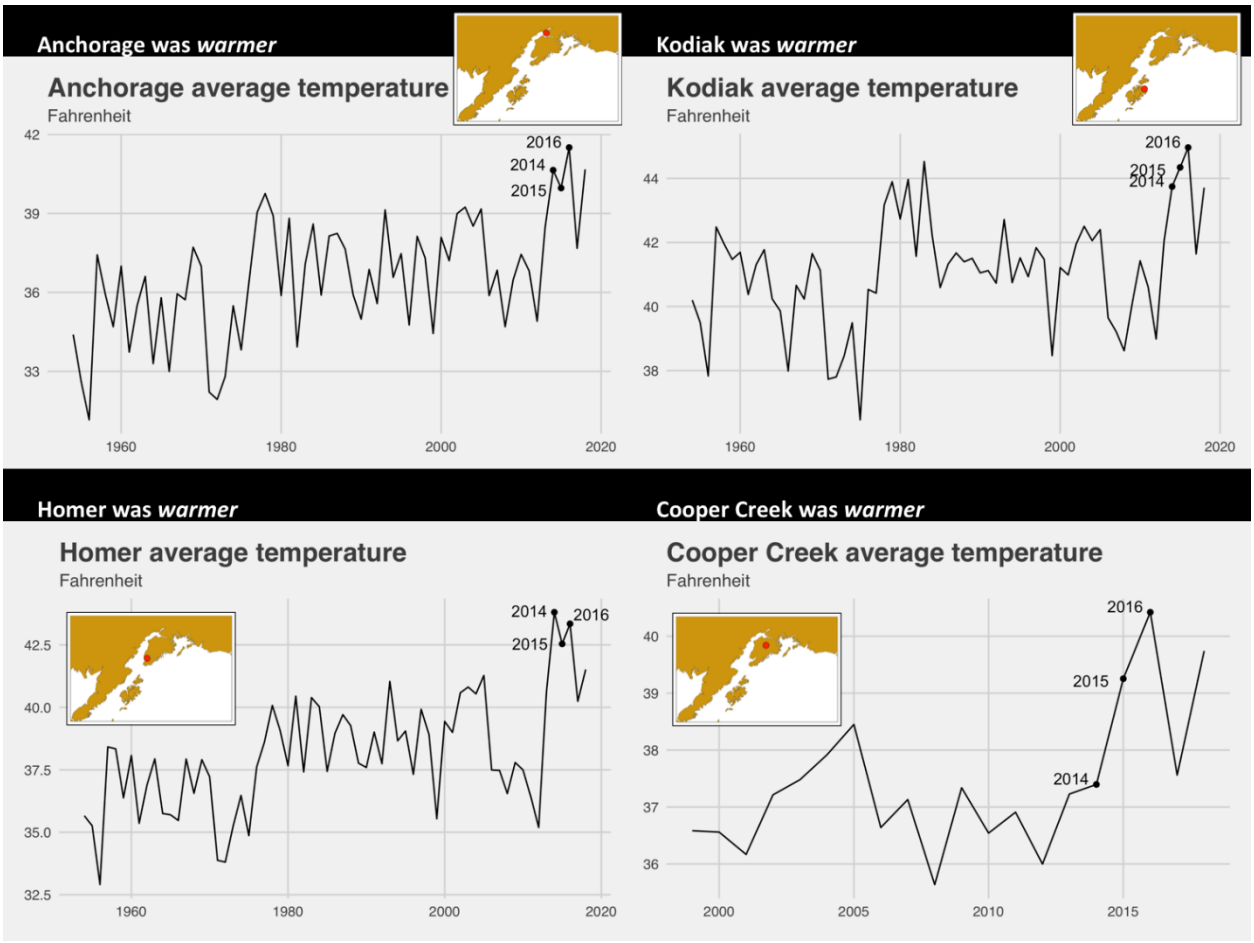


Fig. 2. Unusual air and river temperatures in Southcentral Alaska during 2014-2016.

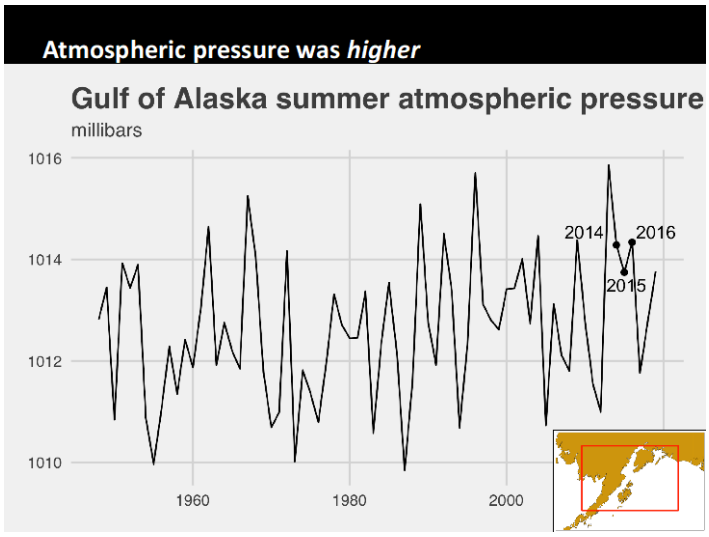


Fig. 3. Summer atmospheric pressure over the Gulf of Alaska, 1950-2018.

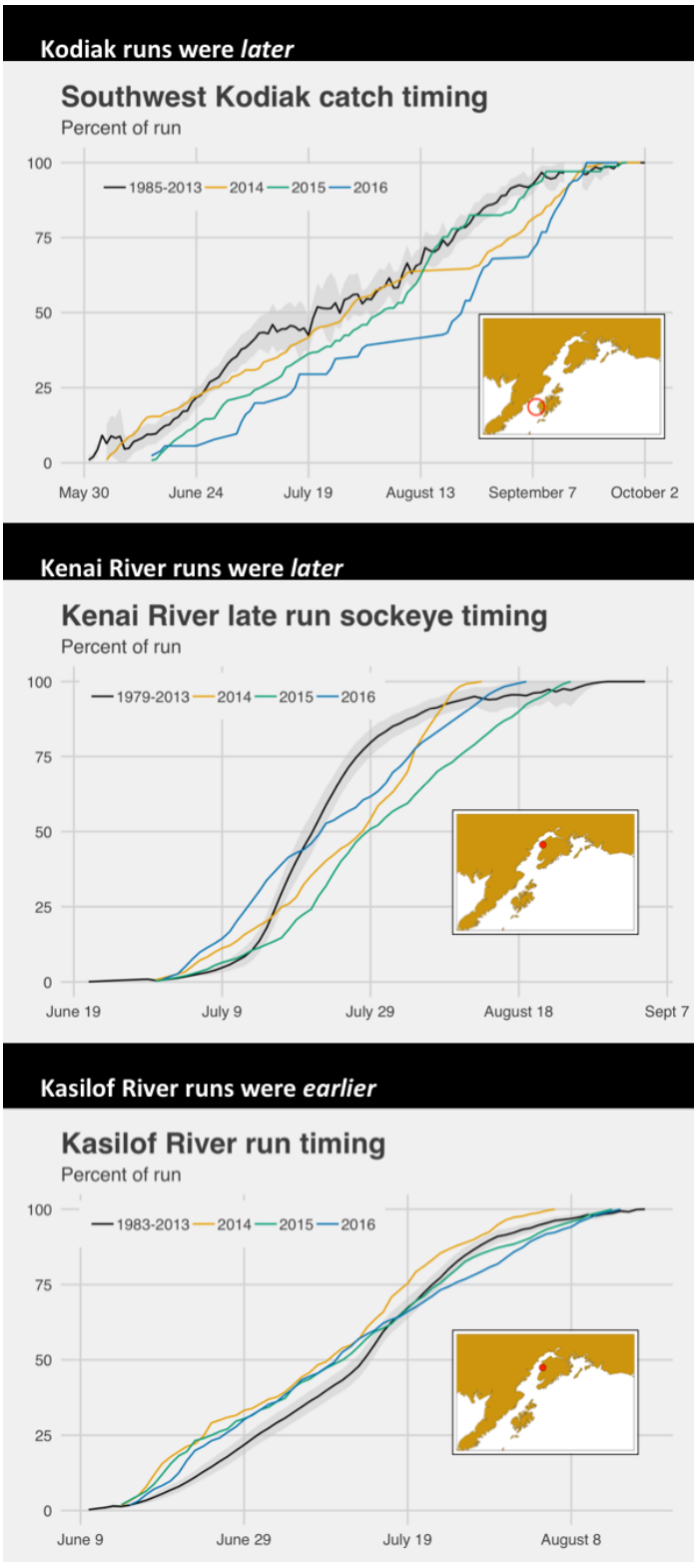


Fig. 4. Run timing of Southwest Kodiak, Kenai River, and Kasilof River sockeye salmon during 2014-2016 compared to long-term means.

Linking Ocean Temperate and Sockeye Run Timing

At-sea migration patterns in salmon remain poorly understood, and no data are available concerning the distribution and timing of Gulf of Alaska sockeye salmon returning to natal rivers during the period of interest. However, extensive records are available for the timing of commercial catches and escapement for important stocks, and these data provide the best available information for understanding recent changes in sockeye migration. Sockeye salmon run timing was estimated for this report with data on both escapement from a variety of Gulf of Alaska runs, as well as commercial catch data from both Upper Cook Inlet and the Kodiak Management Area (details in Data Sources and Methods). Several important sockeye runs showed run timing during 2014-2016 that was highly unusual when compared to long-term means (Fig. 4), suggesting that the unusual climate conditions during these years affected sockeye migration patterns.

In order to formally analyze the relationship between climate conditions and run timing, data were standardized across different long-term time series by calculating the day of the year in which 50% of the total run (catch or escapement) had occurred in each year (Quinn and Adams 1996). A Dynamic Factor Analysis (DFA) model was then used to summarize variability across the many different run timing information sources (Zuur et al. 2003). This DFA model showed evidence of shared variability (positive loadings) for Southwest Kodiak catches and Kasilof and Kenai River escapement. A variety of other data sources had weaker loadings on the shared trend (Fig. 5). The shared trend of variability in run timing showed an increasing trend since the early 2000s, with a further step increase beginning around 2014 (Fig. 6). Positive values in this

shared trend indicate a change towards later runs in time series with positive loadings, and earlier runs in time series with negative loadings.

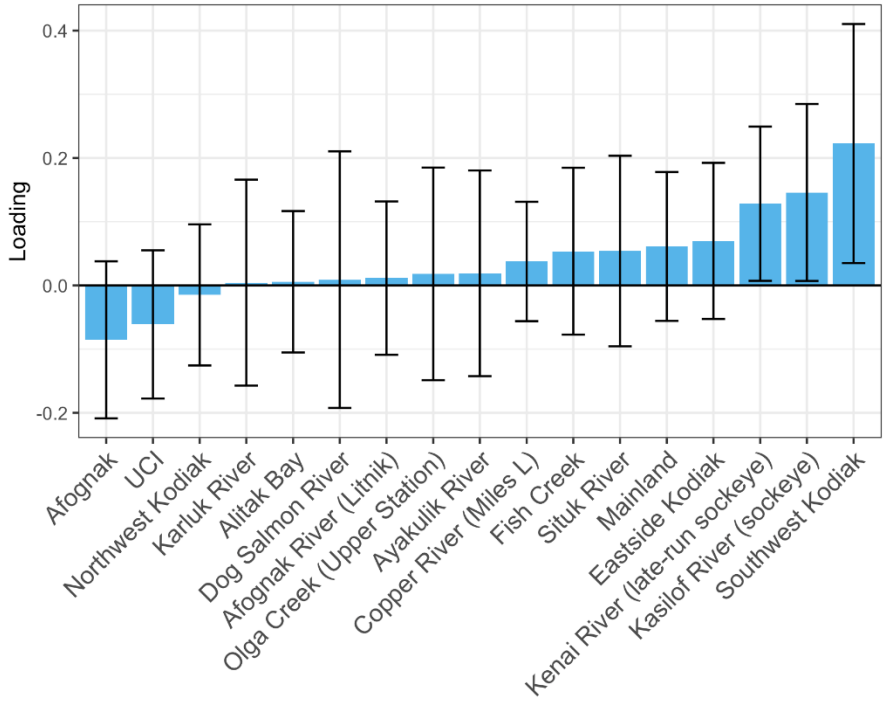


Fig. 5. Dynamic Factor Analysis summary of Gulf of Alaska sockeye salmon run timing, 1978-2019. Loadings on individual escapement and catch time series (day of year when 50% of run has occurred in each year, estimates with 95% confidence intervals). Time series with positive loadings are later when shared trend goes up; time series with negative trends are earlier when the shared trend goes up. UCI = = Upper Cook Inlet total commercial catch.

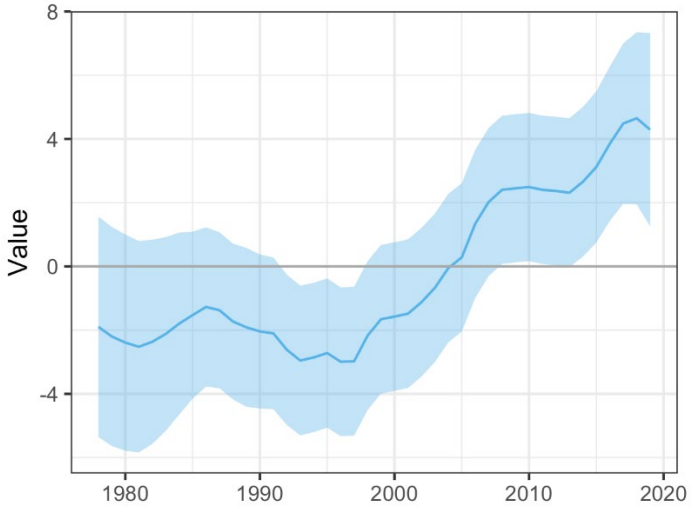


Fig. 6. Shared trend in sockeye run timing (estimate and 95% confidence interval) from DFA model. Value of 0 indicates average overall timing.

A variety of different Gulf of Alaska climate variables may influence sockeye salmon run timing, including sea surface temperature, sea level atmospheric pressure, river temperature, and river flow. A DFA model was again used to summarize variability across these different climate variables. This DFA model summarized overall climate variability as a combination of positive loadings for a range

of air, sea, and river temperature time series, and negative loadings for stream flow in Cooper Creek (Kenai River drainage) and Willow Creek (Susitna River Drainage; Fig. 7). In other words the model captures the tendency for temperatures at different sites to vary together, and for stream flow at those two Southcentral Alaska sites to decline in warm conditions. The shared trend of climate variability from this DFA model clearly shows the transition to extreme conditions since 2014 (Fig. 8).

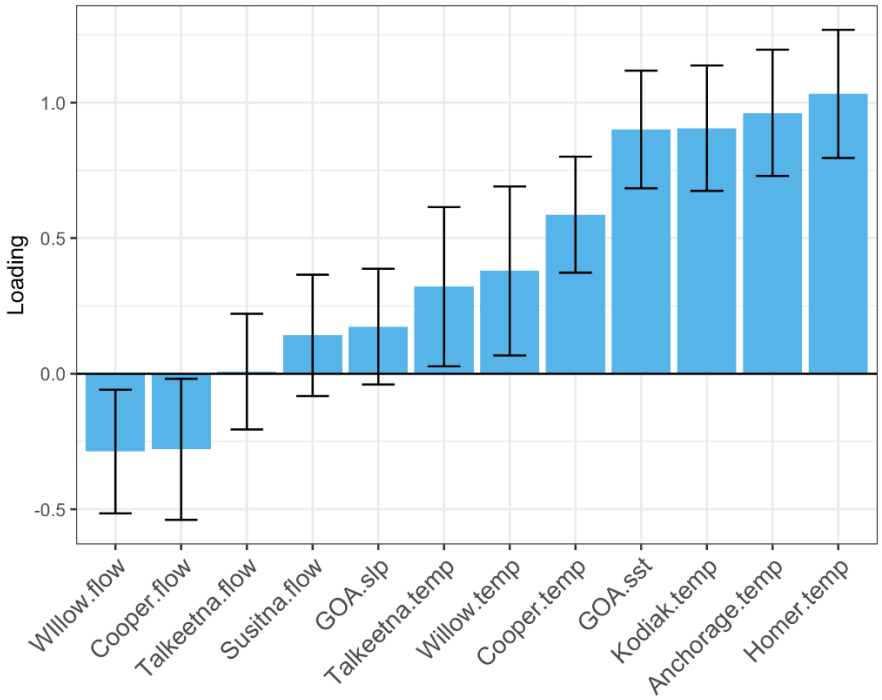


Fig. 7. Dynamic Factor Analysis summary of Gulf of Alaska and South-Central climate, 1978-2019. Loadings on individual climate time series (estimates with 95% confidence intervals). Time series with positive loadings go up when the shared trend goes up; time series with negative trends go down when the shared trend goes up. GOA.slp = Gulf of Alaska sea level atmospheric pressure, GOA.sst = Gulf of Alaska sea surface temperature.

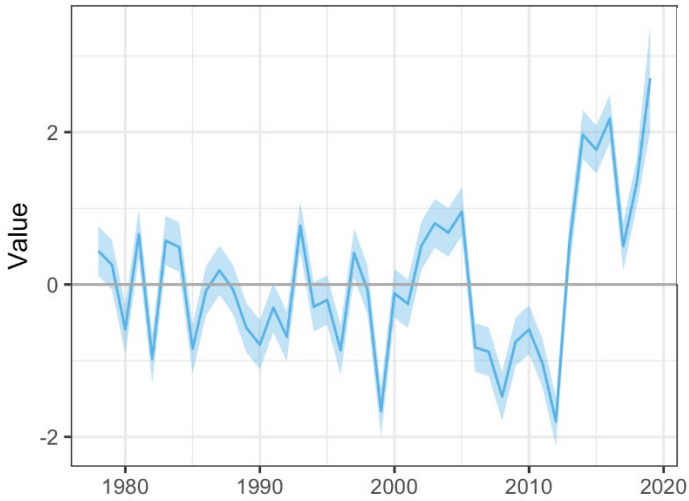


Fig. 8. Shared trend in climate variability (estimate and 95% confidence interval) from DFA model. Value of 0 indicates average conditions.

These results confirm that overall trends in both overall sockeye run timing (Fig. 6) and overall climate conditions for sockeye (Fig. 8) have been at unprecedented levels since 2014. The next step of the analysis is to evaluate the evidence that the two trends are related. An initial examination of possible driver-response relationships with a scatter plot of annual values in the climate trend and the sockeye run timing trend suggests a highly nonlinear relationship, with two distinct clusters of observations in the 1978-2019 time period (Fig. 9). This initial result suggests the possibility of two overlapping mathematical functions describing climate effects on salmon, occupying different parts of the time series. This kind of complex driver-response relationship, sometimes referred to as "alternative stable states" is a common feature of ecosystems experiencing disturbance from external factors such as climate change (Scheffer et al. 2012, Litzow and Hunsicker 2016). *This scatter plot also illustrates the highly unusual nature of the 2014-2016 period for both climate conditions and sockeye run timing: both quantities were at unprecedented levels in 2014-2016.*

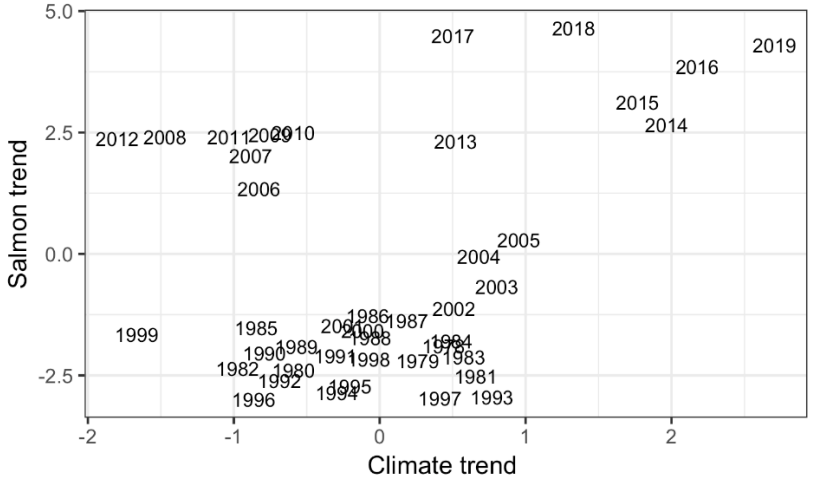


Fig. 9. Time series of climate conditions (shared trend from climate DFA model; driver variable) and sockeye run timing (shared trend from salmon DFA model; response variable).

The next step in this analysis was to test for meaningful relationships between sockeye run timing and climate state. This part of the analysis answers the question of whether there is evidence that run timing is responding to changes in the climate. This analysis used Bayesian linear regression models to determine if the slope of sockeye run timing on the shared climate trend (unit change in run timing per unit change in climate) is different from zero. These models do support the hypothesis of a meaningful relationship between climate state and run timing with an estimated slope that is clearly different from zero. These models also indicate that the relationship is strengthening over time (increasing intercept since the early 2000s (Fig. 10).

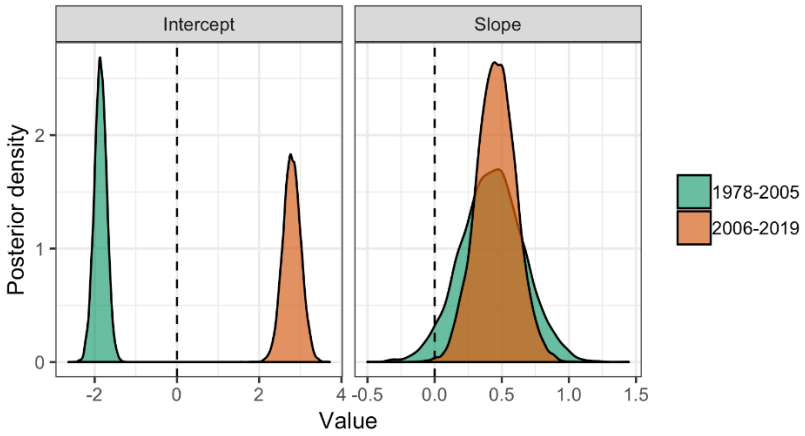


Fig. 10. Era-specific relationships between shared climate trend and shared trend in sockeye salmon run timing: posterior distributions for intercept and slope from Bayesian linear regression fit separately to data from 1978-2005 and 2006-2019.

As noted earlier, this kind of time-dependent driver-response relationship is a common feature of ecosystems experiencing external forcing (Scheffer et al. 2012), especially in instances of changing climate variables (Wolkovich et al. 2014). However, the causes of this kind of complex, nonlinear relationship are typically very difficult to determine, and understanding the apparent jump in sockeye response to climate forcing is beyond the scope of this report. What is apparent is the effect of the simultaneous change in run timing and climate: 2019 was the most extreme year on record for the climate trend, and 2017-2019 were the most unusual years on record for the shared trend in sockeye run timing, with 2014-2016 close behind (Fig. 9). In addition, a sensitivity analysis shows that similar results were obtained when only escapement time series were analyzed, indicating that management changes to catch timing do not explain changing run timing in recent years (results not shown).

Ecosystem Context

In addition to the unusual sockeye run timing noted above, a wide range of ecosystem responses to unusual climate conditions have been noted since 2014 in the Gulf of Alaska. These include the largest-ever observed mass mortality event for common murres and a variety of other chronic seabird mass mortality events; acute and chronic production of neurotoxins by harmful algal blooms (McCabe et al. 2016, Roggatz et al. 2019); significant mortality in humpback whales; unprecedented irruptions of pelagic colonial tunicates (*Pyrosoma* sp.); fisheries failures for Pacific cod and pink salmon; unusual patterns of primary productivity (spring blooms that are unusually early and small; Litzow et al. in prep), and shifts in zooplankton abundance and community structure (Litzow et al. in prep.). Taken together, these responses underscore the unusual nature of both the initial 2014-2016 Warm Blob and subsequent years, and the potential for continuing ecological change as long as the current warming event lasts.

Implications for Management

A very high degree of uncertainty currently attends ecosystem status in the Gulf of Alaska, both for the specific question of sockeye run timing and stock mixing, and for broader questions of stability in the ecosystem and fisheries. While the 2014-2016 return years were highly unusual for sockeye run timing as measured by the shared trend of run timing variability, even these extreme values have been exceeded during 2017-2019 (Fig. 3b). Given that biological responses to ecosystem perturbations such as climate forcing are complex and often lagged in time (Frank et al. 2011, Hughes et al. 2013), and that climate conditions have again returned to levels commensurate with those seen in 2016, the full scope of biological consequences of the current climate event has likely not yet become apparent. *In this situation of rapid change outside the envelope of historical conditions, the ability of data from 2014-2016 to serve as a reliable guide for future conditions is highly questionable.* The speed of change currently occurring in the Gulf of Alaska underscores the caution provided by Shedd et al. (2016) concerning the use of their data in situations materially different from those under which the study took place, and suggests the need for a precautionary approach to possible management changes based on these results.

Data Sources and Methods

Sea surface temperature data were extracted from the NOAA Extended Reconstructed Sea Surface Temperature data set (ncdc.noaa.gov). Sea level pressure data come from the NCEP/NCAR Reanalysis (esrl.noaa.gov). River temperature and river flow data come from the US Geological Survey (waterdata.usgs.gov). Air temperature data come from the Alaska Climate Research Center (climate.gi.alaska.edu). Data on sockeye run timing come both from escapement counts and commercial catch data obtained from ADF&G (adfg.alaska.gov). DFA models were fit following the recommendations of Holmes et al. (2018). Bayesian regression models were fit following the recommendations of Gelman et al. (2014).

References

Bond, N. A., M. F. Cronin, H. Freeland, and N. Mantua. 2015. Causes and impacts of the 2014 warm anomaly in the NE Pacific. Geophysical Research Letters 42:3414–3420.

Frank, K. T., B. Petrie, J. A. D. Fisher, and W. C. Leggett. 2011. Transient dynamics of an altered large marine ecosystem. Nature 477:86–89.

Gelman, A., J. B. Carlin, H. S. Stern, D. B. Dunson, A. Vehtari, and D. B. Rubin. 2014. Bayesian Data Analysis. Chapman & Hall, Boca Raton. Florida.

Hobday, A. J., E. C. J. Oliver, A. Sen Gupta, J. A. Benthuysen, M. T. Burrows, M. G. Donat, N. J. Holbrook, P. J. Moore, M. S. Thomsen, T. Wernberg, and D. A. Smale. 2018. Categorizing and naming marine heatwaves. Oceanography 31.

Hodgson, S., and T. P. Quinn. 2002. The timing of adult sockeye salmon migration into fresh water: adaptations by populations to prevailing thermal regimes. CANADIAN JOURNAL OF ZOOLOGY-REVUE CANADIENNE DE ZOOLOGIE 80:542–555.

Hodgson, S., T. P. Quinn, R. Hilborn, R. C. Francis, and D. E. Rogers. 2006. Marine and freshwater climatic factors affecting interannual variation in the timing of return migration to fresh water of sockeye salmon (Oncorhynchus nerka). Fisheries Oceanography 15:1–24.

Holmes, E. E., E. J. Ward, and M. D. Scheuerell. 2018. Analysis of multivariate time-series using the MARSS package. Seattle, USA.

Hughes, T. P., C. Linares, V. Dakos, I. A. van de Leemput, and E. H. van Nes. 2013. Living dangerously on borrowed time during slow, unrecognized regime shifts. Trends in Ecology & Evolution 28:149–155.

Litzow, M. A., and M. E. Hunsicker. 2016. Early warning signals, nonlinearity, and signs of hysteresis in real ecosystems. Ecosphere 7.

Di Lorenzo, E., and N. Mantua. 2016. Multi-year persistence of the 2014/15 North Pacific marine heatwave. Nature Climate Change 6:1042–1047.

McCabe, R. M., B. M. Hickey, R. M. Kudela, K. A. Lefebvre, N. G. Adams, B. D. Bill, F. M. D. Gulland, R. E. Thomson, W. P. Cochlan, and V. L. Trainer. 2016. An unprecedented coastwide toxic algal bloom linked to anomalous ocean conditions. Geophysical Research Letters 43:10,310-366,376.

Quinn, T. P., and D. J. Adams. 1996. Environmental changes affecting the migratory timing of American shad and sockeye salmon. ECOLOGY 77:1151–1162.

Roggatz, C. C., N. Fletcher, D. M. Benoit, A. C. Algar, A. Doroff, B. Wright, K. C. Wollenberg Valero, and J. D. Hardege. 2019. Saxitoxin and tetrodotoxin bioavailability increases in future oceans. Nature Climate Change.

Scheffer, M., S. R. Carpenter, T. M. Lenton, J. Bascompte, W. Brock, V. Dakos, J. van de Koppel, I. A. van de Leemput, S. A. Levin, E. H. van Nes, M. Pascual, and J. Vandermeer. 2012. Anticipating critical transitions. Science 338:344–348.

Shedd, K. R., M. B. Foster, T. H. Dann, H. A. Hoyt, M. L. Wattum, and C. Habicht. 2016. Genetic stock composition of the commercial harvest of sockeye salmon in Kodiak Management Area, 2014-2016. Alaska Department of Fish and Game.

Walsh, J. E., R. L. Thoman, U. S. Bhatt, P. A. Bieniek, B. Brettschneider, M. Brubaker, S. Danielson, R. Lader, F. Fetterer, K. Holderied, K. Iken, A. Mahoney, M. McCammon, and J. Partain. 2018. The

high latitude heat wave of 2016 and its impacts on Alaska. Bulletin of the American Meteorological Society 99:S39–S43.

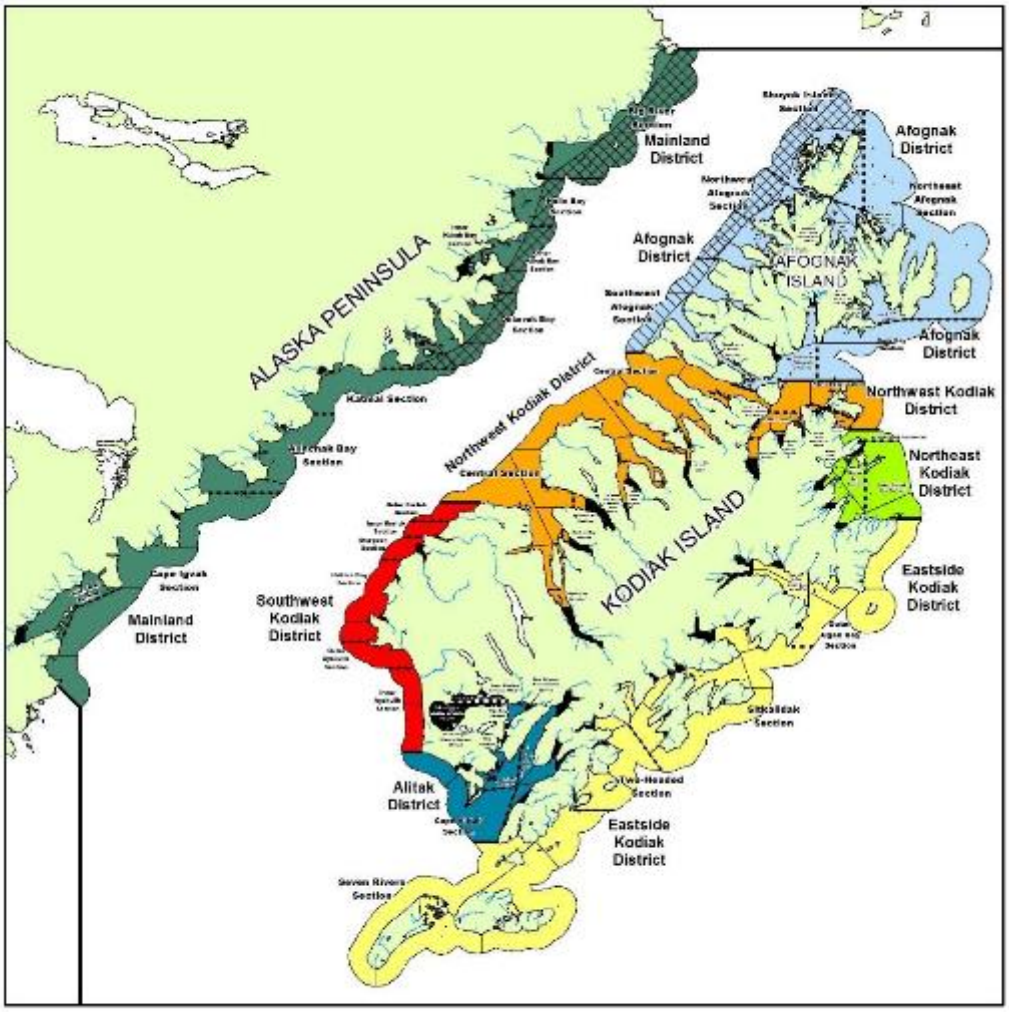
Wolkovich, E. M., B. I. Cook, K. K. McLauchlan, and T. J. Davies. 2014. Temporal ecology in the Anthropocene. Ecology Letters 17:1365–1379.

Zuur, A. F., R. J. Fryer, I. T. Jolliffe, R. Dekker, and J. J. Beukema. 2003. Estimating common trends in multivariate time series using dynamic factor analysis. Environmetrics 14:665–685.

Appendix A – Author's Biographical Statement

Dr. Michael Litzow is a fisheries oceanographer who studies the impacts of climate variability and climate change on commercially important fish stocks in Alaska. He obtained his B.S. in Biological Sciences from the University of Alaska, Fairbanks, his M.S. in Marine Science from the University of California, Santa Cruz, and his Ph.D. in Ocean Sciences from the University of Tasmania, Australia. Dr. Litzow's recent research has focused on the effects of changing ocean climate on Gulf of Alaska salmon stocks. His previous research has involved a variety of taxa, including groundfish, crabs, shrimp, herring, other forage fish, and seabirds, and he is the author of thirty peer-reviewed papers. Dr. Litzow is the owner of Blue World Research, a private consulting firm, and until recently was a research faculty member at the University of Alaska, College of Fisheries and Ocean Sciences.

December 2019



Synthesis of Chinook Salmon Stock Contribution Estimates within the Kodiak Management Area **Commercial Salmon Fisheries (Proposals 63 & 37)**

Kodiak Salmon Work Group

EXECUTIVE SUMMARY

- During all years and sampling periods regardless of the commercial salmon fishery district sampled, British Columbia (hatchery stocks) Chinook salmon dominated the

stock composition of the harvest. Estimates of contribution ranged from a low of 30% to a high of 70% with respective harvests of several hundred to several thousand fish.

- Consistently, contributions from Washington and Oregon Chinook stocks (Western US stocks) to the KMA commercial harvest ranged from 7.3% to 37% and averaged 28%.

- Contributions from Southeast Alaska/North Gulf Coast were in most cases higher than the combined contributions from both Kodiak and Cook Inlet. The estimates generally seemed to be reflective of periods of higher (1997-1999) and lower abundance (2014-2016) for Southeast Alaska stocks.

- The capability of any marine salmon fisheries sampling program to consistently estimate the harvest, in a timely manner, of at most several hundred fish over a commercial fishing season within the geographic scope of the Kodiak Management Area is untenable. Given the current status of both the Kodiak and Cook Inlet Chinook salmon stocks at present, the actions suggested by Proposal 37 are unwarranted.

- It should be noted that for the Cook Inlet stocks harvested within the Kodiak Management Area, a majority are hatchery fish produced for marine or in-river sport fisheries.

- The Chinook salmon stocks contributing to the Kodiak Management Area commercial fishery are similar to those contributing to most of the marine commercial and recreational fisheries from Yakutat to Adak, or coastwide.

INTRODUCTION

The Kodiak Management Area and the associated salmon fisheries has a long and storied history of sustainable fisheries management success. A foundational feature for this success is the escapement enumeration program using weirs and counting individual fish as they migrate upstream. This program has largely been in place since the early 1900s with weirs operated annually on the Karluk, Ayakulik and Frazer lake systems. Daily and cumulative escapement counts are relayed to the area management office for each system and when combined with other sources of data: harvests, aerial survey index counts (for systems without weirs), fishing effort along with additional biological data (timing, migration patterns, age composition) are all sourced into fishery management decisions and emergency orders to open or close districts, sections and subsections of fishing areas throughout the salmon fishing season. An additional vital feature of this program is the inclusion of enclosures or “traps” that allow for live sampling of the escapement, specifically for sockeye and Chinook salmon and the collection of biological attribute data (age, sex, length) which is imperative for building brood tables which in turn are employed for establishing and evaluating biological escapement goals and generating pre-season forecasts.

An additional prominent feature of the Kodiak Management Area salmon fisheries are the 7 management plans which guide management of the salmon stocks and species during the salmon

fishing season which commences in early to mid-June and extends into late September. The management planning process was largely initiated in the mid to late 1970s which was a period of extremely poor salmon production throughout the entire Kodiak Archipelago and was cause for multiple years of limited commercial fishing by all gear groups with the overall objective of rebuilding wild salmon stocks. These management plans were the result of extensive efforts by ADF&G management and research biologists, commercial fishermen, the local fish and game advisory committee and ultimately the Alaska Board of Fisheries over multiple triannual meetings (Malloy, 1988).

Description of Kodiak Chinook Salmon Fishery

The Kodiak Island area has two wild chinook salmon stocks (Karluk and Ayakulik Rivers) and one introduced run which originates in the Dog Salmon River. There have also been several hatchery produced chinook release sites permitted that promote road accessible shore/boat recreational fisheries. The commercial seine and set gillnet fisheries harvest Chinook salmon incidentally while targeting local sockeye, chum and pink salmon stocks along nearshore migration pathways. The harvests typically occur during June and July and at times the harvests can consist of immature or feeder Chinook that are traversing well established commercial fishing areas in the Westside, Southwest and Alitak Districts. The record commercial harvest of 42,000 fish in 1993 consisted of large numbers of immature/feeder kings and stimulated concern from the recreational sector within the Cook Inlet area that large numbers of the harvested fish were of Cook Inlet origin. The harvest during 1993 was almost twice the previous high estimate of 24,000 fish, which occurred in 1992. As a back drop to this concern, several chinook salmon stocks within Cook Inlet were experiencing poor production (Deshka and Early Run Kenai R.) while simultaneously there was a serge in production from stocks originating in British Columbia, Washington and Oregon which were largely of hatchery origin; a portion of these hatchery fish were marked with a coded wire tag and missing the adipose fin (Swanton, 1997). There are several hatchery stocks in Cook Inlet that were marked and could thereby serve for detecting the presence of these stocks in the Kodiak Fishery. A pilot commercial catch sampling program was initiated in 1994 (Swanton 1997) and was followed by a focused interdivisional sampling and harvest estimation program for the years 1997-1999 (Clark and Nelson 2001). A more contemporary and comprehensive genetic stock identification (GSI) program was conducted for the years 2014-2016 and generally corroborated previous results (Shedd et al. 2016).

North American Chinook salmon Ocean Migrations

There are literally hundreds of Chinook Salmon stocks spanning the Coastline from Oregon, Washington, British Columbia and throughout Alaska from Southeast and along the Alaska Peninsula; these stocks are often referenced as far north migrating stocks, as opposed to stocks that have more localized or truncated ocean migrations. With the advent of Coded Wire Tagging (early 1970s) coupled with extensive High Seas Tagging (conducted throughout the North Pacific) and scale pattern analyses efforts conducted by the University of Washington much insight was gleaned regarding migration patterns along coastal and open ocean migration routes. Substantial increases in hatchery production of Chinook salmon in Oregon, Washington and British Columbia occurred in the early 1990s which resulted in a surge in coastwide abundance. Much of the increased hatchery production was in response to poor production from wild stocks, compensation for habitat destruction, tribal agreements, hydroelectric dam impacts or mitigation owing to wild stock endangered species act (ESA) listings.

Coastwide abundance of feeding/rearing Chinook increased markedly and harvests of Chinook increased both within Alaska's commercial and recreational coastal marine fisheries as well as bycatch of chinook in federal fisheries operating in the Gulf of Alaska. The Pacific Salmon Treaty between the United States and Canada governs harvests of these stocks throughout Southeast Alaska (Ketchikan to Yakutat) where jurisdiction between the parties ends. The harvest of these stocks throughout the remainder of the Gulf of Alaska is viewed with recognition that they originate in other states or British Columbia and harvest should be limited or constrained where appropriate. This has been the policy direction followed by both ADF&G and the Alaska Board of Fisheries certainly within the last 10-15 years and pertains to Kodiak, Kachemak Bay and Homer spring and winter recreational fisheries and both commercial and recreational fisheries prosecuted in Prince William Sound.

Data Summaries by Year

(Swanton, 1997) Caution is suggested relative to these estimates owing to low marking fractions and less than optimum temporal and spatial sampling coverage**.**

1994

The two Kodiak commercial fishing areas where CWT sampling occurred (Westside and Alitak Districts) experienced a commercial harvest of 5,089 Chinook salmon (80% CI 2,927-7,253 fish) from marked cohorts which represented 32.5% of the sampled harvest. The stock groupings represented by the tag recoveries were: 9.7% Southeast Alaska; 83% from British Columbia; 4.9% from Washington state and 2.4% from Oregon.

From the Westside Kodiak area most of the marked cohorts were of British Columbia origin with marked fish from Southeast Alaska, Washington and Oregon also detected in lower numbers. There was an apparent temporal change in stock contribution from the week of June 12-18 which were more varied, as compared to the period June 19-25 when only British Columbia and Southeast Alaska stocks were detected. The marked cohort contribution estimates for this area spanning 12 June through 30 July was 4,655 fish (80% CI 2,517-6,793 fish) from a total catch of 14,619 fish or 31.8%.

Within the Alitak Bay District all marked fish recoveries were of British Columbia origin and represented 435 Chinook out of a total catch of 640 fish. This represented 68% of the catch during the period off sampling.

(Clark and Nelson 2001)

1997

During the 1997 Kodiak commercial salmon fishing season there were 18,728 Chinook salmon harvested with 89% of the harvest occurring during the CWT sampling period of 9 June-8 August; a majority 67% of this harvest (about 11,000 fish) took place within the Westside area. The study plan designated a sampling fraction of inspecting 20% of the observed catch for CWT's which is consistent with Coastwide sampling programs sanctioned by the Pacific Salmon Commission.

The number of Chinook salmon inspected for a missing adipose fin in1997 was 6,015 or 36% of the harvest during the sampling period; 37% of the harvest was inspected within the Westside District catch; 60% within the Alitak Bay District; sampling within the Eastside District exceeded 20% and an additional 24% (792 fish) were inspected from harvests within the Mainland fishing District.

The general stock composition from the sampled harvest was: 13% from Alaska stocks, 72% from British Columbia, 7% from Washington and 8% from Oregon Chinook stocks. The 18 tag recoveries from Alaska stocks was further broken down to include 11 recoveries from Cook Inlet: two Kenai River, three Ship Creek, three Ninilchik River, one from Deception Cr., one from Crooked R. and one from Homer Spit.

1998

In 1998 there were 17,341 Chinook harvested commercially during the sampling period 9 June-8 August with approximately 93% occurring within the Westside (including the Southwest Afognak Section and Northwest Kodiak District), Alitak Bay and Eastside Kodiak Districts. There was 53% of this harvest sampled: 45% in the Westside District, 50% in the Alitak District and 43% within the Eastside District. No samples were collected from the Mainland District as the overall catch was 393 fish.

The identified tagged fish were represented as follows: 31% (79) were Alaska stocks; 49% (125) were from British Columbia; 15% from Washington and 5% from Oregon. The Alaskan stocks originating in Cook Inlet (46 tag recoveries) were three from Resurrection Bay; 5 from Seldovia Harbor; 10 from Homer Spit; 5 from Halibut Cove; 6 from Ninilchik R., 13 from Deception Cr., one from Crooked Cr. and two from the Kenai R. The additional Alaskan stock recoveries were 9 from Southeast Alaska and 24 from the Buskin River.

1999

During the 1999 commercial salmon fishery there were 18,299 Chinook harvested which represented 94% of the harvest that occurred during the June 9-August 8 sampling time frame. About three quarters (73%) of the harvest was realized within the aforementioned fishing areas, and similar to previous years, a majority of the harvest was realized within the Westside Kodiak District. There was 46% of the harvest (7,940 fish) inspected for CWT via a missing adipose fin. Similar to the previous years 45% of the catch was from the Westside District, 41% of the Alitak Bay District. No sampling results were reported for the Eastside District, however 12% of the Mainland District (356 fish) harvest was opportunistically sampled.

There were 201 tag recoveries from the 1999 sampling effort, 124 were from the Westside Kodiak District, 10 from the Mainland District, 20 from the Eastside and three from the Alitak Bay District. There were 32% (64 tagged fish recovered) from Alaska stocks, 31% from British Columbia, 13% from Washington and 24% that originated from Oregon. There were 21 tagged fish recovered that originated from Cook Inlet stocks with distribution by area similar to 1998. The authors after consulting with fishery management staff, suggested that if any non-local stock or stock grouping was estimated to have a 10-15% exploitation rate (harvest rate applied over the entire brood year) imposed by fisheries within the Kodiak Management Area that this would be cause for concern. In addressing this, Clark and Nelson (2001) stated " Therefore, publication of imprecise, but consistently small harvests of Cook Inlet hatchery cohorts in the KMA fishery provided the best indication of the lack of importance of the KMA fishery in influencing production of chinook salmon bound for Cook Inlet."

(Shedd et al. 2016)

This study employed genetic stock identification techniques to generate stock contribution estimates for chinook salmon harvested within both the commercial and recreational fisheries throughout the Westward Region (Kodiak, Chignik and the Alaska Peninsula Management areas). The information summarized below is only for the commercial fishery within the Kodiak

Management Area to maintain consistency in comparing other information presented within this summary. This study focused on 4 Districts/reporting areas and two temporal strata (Early: 1 June-5 July; Late: 6 July-5 August).

2014

Overall, there were 8,382 fish commercially harvested of which 3,050 fish were sampled (sampling fraction of 36.4%) for all areas and time strata. The results of GSI for the entire time and area strata were: 55.6% British Columbia, 34% West Coast US (Washington and Oregon stocks combined), 3.4% Southeast Alaska and Northeast Gulf of Alaska stocks(Southeast Alaska/Gulf Coast, 2.6% Cook Inlet, 1.9% Kodiak and 1.6% referred to as the Eastern Bering Sea stock grouping. The following are the aggregate stock composition estimates broken down by geographical and temporal strata:

Northwest Kodiak District and Afognak(Statistical Areas: 251, 253 and 254)

- Early (1 June-July 5) 72.1% British Columbia stocks, 15.7% West Coast US, 4.3% Kodiak, 2.7% Cook Inlet and 2.4% Southeast Alaska/North Gulf Coast Alaska.
- Late (July 6-August 5) 56.0% British Columbia stocks, 34.7% West Coast US, 4.6% Southeast Alaska/Gulf Coast, 2.2% Cook Inlet and 1.2% Kodiak Stocks.

Eastside Kodiak and Afognak District (Statistical Areas: 258, 259 and 252)

- Early (1 June-July 5): 51.2% British Columbia Chinook stocks, 35.3% West Coast US, 4.2% Southeast Alaska/Gulf Coast, 0.3% Cook Inlet and 4.2% Kodiak stocks.
- Late (July 6- August 5):51.7% British Columbia stocks, 37.5% West Coast US, 2.6% Southeast Alaska/Gulf Coast, 4.0% Cook Inlet and 0.1% Kodiak Chinook salmon stocks.

Southwest Kodiak Alitak Districts (Statistical Areas: 255, 256 and 257)

- Early (June 1-July 5): 51.2% British Columbia stocks, 30.8% West Coast US, 6.1% Southeast Alaska and Gulf Coast, 1.1 % Cook Inlet and 10.0% Kodiak Stocks.
- Late (July 6-August 5): 54.5% British Columbia, 39.0% West Coast US, 2.9% Southeast Alaska/Gulf Coast, 1.4% Cook Inlet and 1.0% Kodiak stocks.

Mainland District (Statistical Area 262) There was no sampling conducted for the "Early" strata during 2014.

- Late: July 6-August 5): 51.2% British Columbia Stocks, 39.5% West Coast US stocks, 4.8% Southeast Alaska/Gulf Coast, 1.5% Cook Inlet and 0.9% Kodiak stocks.

2015

During 2015 the Chinook harvest was 8,087 of which 2,775 fish were sampled resulting in a 34% sampling fraction. The estimated stock contributions for this commercial fishing season were: 51.6% British Columbia, 33.9% West Coast US, 4.9% Southeast Alaska/Gulf Coast, 4.5% Cook Inlet and 4.5% Kodiak.

Northwest Kodiak District and Afognak(Statistical Areas: 251, 253 and 254)

- Early (June 1-July 5): 54.8% British Columbia, 24.3% West Coast US, 8.5% Southeast Alaska/Gulf Coast, 6.4% Cook Inlet and 4.5% Kodiak.
- Late (July 6-August 5):52.1% British Columbia, 34.9% West Coast US, 4.9% Southeast Alaska and Gulf Coast, 4.3% Cook Inlet and 3.2% Kodiak.

Eastside Kodiak and Afognak District (Statistical Areas: 258, 259 and 252)

- Early (June 1-July 5):36.4% British Columbia stocks, 46.8 West Coast US stocks, 4.8% Southeast Alaska and Gulf Coast stocks, 7.8% Cook Inlet and 3.1% Kodiak Chinook Stocks.
- Late (July 6-August 5):49.4% British Columbia stocks, 40.7 West Coast US stocks, 3.5% Southeast Alaska and Gulf Coast, 1.3% Cook Inlet and 4.3% Kodiak Chinook stocks.

Southwest Kodiak and Alitak Districts (Statistical Areas: 255, 256 and 257)

- Early (June 1- July 5): 33.8% British Columbia stocks, 35.2% West Coast US, 3.2% Southeast Alaska/Gulf Coast stocks, 2.5% Cook Inlet and 24.9% Kodiak Stocks.
- Late (July 6-August 5):63.1% British Columbia stocks, 30.3% West Coast US, 3.4% Southeast Alaska and Gulf Coast stocks, 1.4% Cook Inlet and 1.2% Kodiak Chinook stock contributions.

Mainland District (Statistical Area 262) Similar to 2014, there was no sampling conducted during 2015 within the period June 1- July 5 for this district.

- Late (July 6-August 5): 64% British Columbia stocks, 19.6% West Coast US, 3.0% Southeast Alaska/Gulf Coast, 12.8% Cook Inlet stocks and no contribution from Kodiak Chinook stocks.

2016

The harvest during 2016 was only 7,471 Chinook of which 3,189 fish were sampled, which represented a 43% sampling fraction. The various stock contributions to the commercial harvest for 2016 were: 56.5% British Columbia, 30.6% West Coast US, 6.2% Southeast Alaska/Gulf Coast, 3.8% Cook Inlet and 1.3% Kodiak stocks.

Northwest Kodiak District and Afognak (Statistical Areas: 251, 253 and 254)

- Early (June 1-July 5): 59.6% British Columbia stocks, 15.0% West Coast US, 12.7% Southeast Alaska and Gulf Coast, 7.8% Cook Inlet and 3.2% Kodiak stocks.
- Late (July 6-August 5):61.8% British Columbia stocks, 17.3% West Coast US, 11.5% Southeast Alaska and Gulf Coast, 6.7% Cook Inlet stocks and 1.6% Kodiak stocks.

Eastside Kodiak and Afognak District (Statistical Areas: 258, 259 and 252)

- Early (June 1- July 5): 57% British Columbia stocks, 27.4% West Coast US Chinook stocks, 6.4% Southeast Alaska/Gulf Coast, 2.3% Cook Inlet and 2.6% Kodiak stocks.
- Late (July 6-August 5):51.5% British Columbia Chinook stocks, 39.5% West Coast US stocks, 1.3% Southeast Alaska/Gulf Coast stocks, 3.8% Cook Inlet and 2.8% Kodiak stocks.

Southwest Kodiak and Alitak Districts (Statistical Areas: 255, 256 and 257)

- Early (June 1-July 5): 67.1% British Columbia, 24.6% West Coast US stocks, 3.1% Southeast Alaska/Gulf Coast, 1.4% Cook Inlet and 2.9% Kodiak stocks.
- Late (July 6-August 5): 69.2% British Columbia stocks, 24.7% West Coast US, 1.8% Southeast Alaska, 2.5% Cook Inlet stocks and 1.1% Kodiak Chinook stocks.

Mainland District (Statistical Area 262)

- Early (June 1-July 5): 46.6% British Columbia stocks, 44.1% West Coast US, 3.6% Southeast Alaska and Gulf Coast, 1.9% Cook Inlet and 0.3% Kodiak stocks.

- Late (July 6-August 5):54.1% British Columbia Chinook stocks, 37.1% West Coast US, 5.1% Southeast Alaska and Gulf Coast, 2.5% Cook Inlet and no contribution from Kodiak Chinook stocks to the harvest.

A direct comparison of the presented information and contribution estimates to the KMA Chinook harvest is difficult because of specific requirements related to CWT estimates and those generated using GSI. For generating reliable harvest estimates using CWT data, a large marking fraction (number of fish marked/total released) combined with a recommended 20% sampling fraction (number of fish sampled from the total catch) is statistically necessary. In the case of both the Kodiak and Cook Inlet Chinook stocks for the years 1994 and 1997-1999, the number of marked fish from the various hatchery releases was small and when combined with low numbers of recoveries, the harvest estimates were uncertain or informative at best. For these reasons, the comparisons of the CWT contributions with those generated using GSI are completed using a simple percent contribution to the overall sampled harvest (Table 1). In reviewing the data, the overall stock contributions are reasonably consistent: British Columbia stocks consistently contribute greater than 50% to the sampled harvest, followed by Washington and Oregon stocks and to a lesser extent Southeast Alaska with minor contributions from either Kodiak or Cook Inlet stocks.

Summary and Recommendations

- During all years and sampling periods regardless of the commercial salmon fishery district sampled, British Columbia Chinook salmon stocks dominated the stock composition of the harvest. Estimates of the percent contribution ranged from a low of 30% to a high of 70%, representing harvests of several hundred to several thousand fish.

- Consistently, contributions from stocks originating in Washington and Oregon (Western US stocks) to the commercial harvests ranged from a low of 7.3% to a high of 37% and averaged 28% of the estimated harvest.

- Contributions from Southeast Alaska/North Gulf Coast were in most cases higher than the combined contributions from both Kodiak and Cook Inlet. These contributions also seem to be reflective of periods of higher and lower abundance when comparing contributions from 1997-1999 (higher abundance) to those from 2014-2016 which was a period of lower Southeast Alaska stock abundance.

- The capability of any marine salmon fisheries sampling program to consistently estimate the harvest in a timely manner, of at most several hundred fish over a commercial fishing season within the geographic scope of the Kodiak Management Area, is untenable.

- Given the stock status of both the Kodiak and Cook Inlet Chinook salmon stocks a regime such as that outlined in Proposal 37 is unwarranted. Both the Kodiak (0%-4.5%) and Cook Inlet (2.6%-4.5%) stock contributions to the Chinook harvest are minor.

- It should be noted that for the Cook Inlet stocks harvested within the Kodiak Management area, a majority are hatchery fish produced for marine or in river sport fisheries. A specific brood stock selection (similar life history and migration traits to the wild stock) and marking program are required for a hatchery stock to be employed as a proxy for wild stocks, therefore the Cook Inlet tag recoveries and rates should not be applied to Cook Inlet wild Chinook salmon stocks.

References

Clark, R.A. and P.A. Nelson, 2001. Assessment of Harvests of Cook Inlet-Origin Chinook Salmon in Commercial Fisheries in the Kodiak Management Area, 1997-1999. Alaska Department of Fish and Game Regional Information Report, No. 4K01-38, Anchorage.

Malloy, L. 1988. Interception of Cook Inlet-Bound Sockeye in the 1988 Kodiak Commercial Salmon Fishery: An In-season management perspective. Alaska Department of Fish and Game Regional Information Report, Kodiak.

Shedd, K. R, K.B. Foster, M. Wattum, T. Polum, M. Witteveen, M. Stratton, T.H. Dann, H.A. Hoyt and C. Habicht. 2016. Genetic Stock Composition of the Commercial and Sport Harvest of Chinook Salmon in Westward Region, 2014-2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-11, Anchorage.

Swanton, C.O. 1997. Incidence and contribution of coded-wire tagged Chinook salmon to Kodiak Management Area Commercial Catches 9 June-6 August, 1994. Alaska Department of Fish and Game Regional Information Report No. 4K97-7, Kodiak.

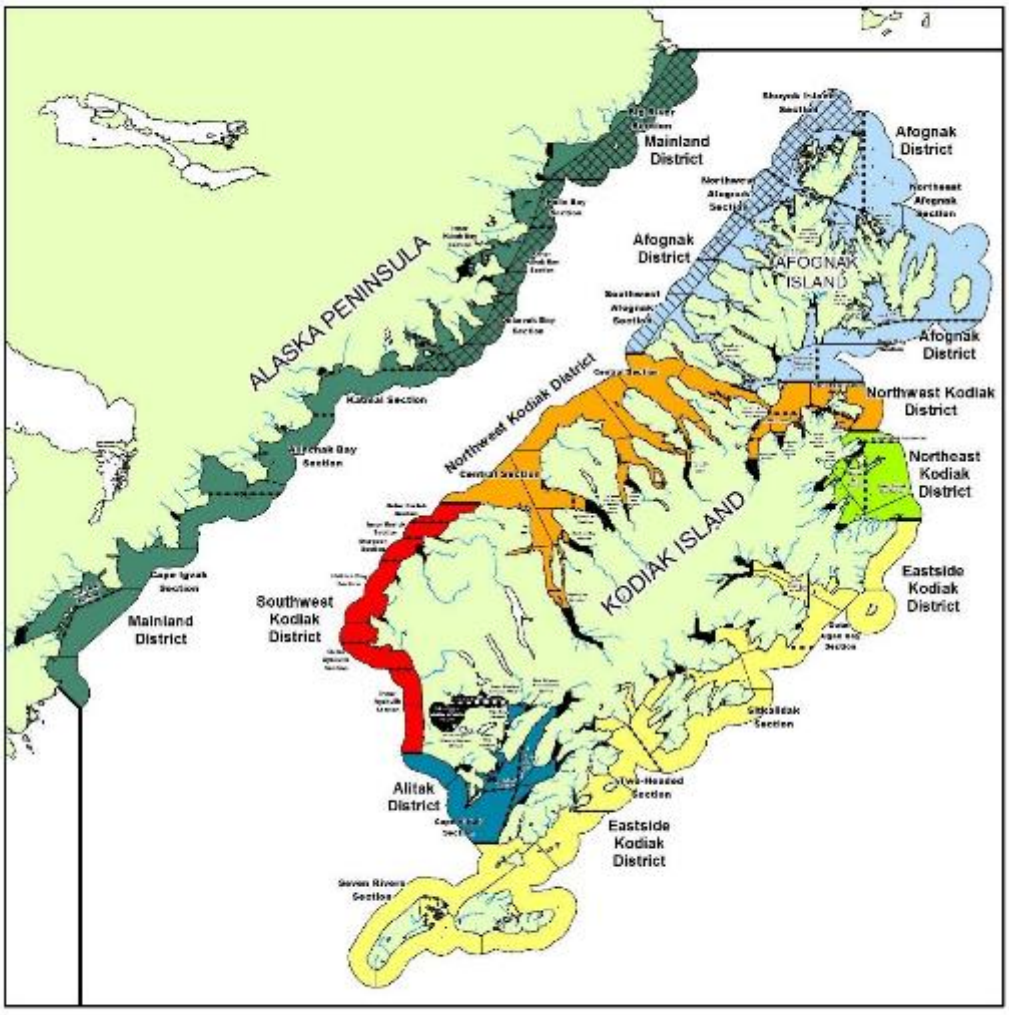
Table 1. Summary of Chinook Stock Group Harvest Percentages in the Kodiak Management Area.

	Calendar Year						
	1994	1997	1998	1999	2014	2015	2016
Sample size	5,089	6,015	9,191	7,940	3,050	2,775	3,189
Stock Group							
British Columbia	83%	72%	49%	31%	56%	52%	57%
Washington &Oregon	7%	15%	20%	37%	34%	34%	31%
SE Alaska/Gulf Coast	10%	13%	31%	32%	3%	5%	6%
Cook Inlet	0%	present[1]	present[1]	present[1]	2%	2%	4%
Kodiak	0%	n/a[2]	n/a[2]	n/a[2]	1%	1%	1%

[1] CWTs were recovered however insufficient totals to estimate a harvest proportion

[2] no CWTs recovered from fishery sampling

December 2019



An

Overview and Contrast of Management Plans and Harvests of Sockeye Salmon Destined for Upper Cook Inlet, 2014-2016.

By the Kodiak Salmon Work Group

The following is germane to addressing **Alaska Board of Fisheries Proposals 64, 65 and 66** which seek to severely curtail fishing time within traditional Kodiak Management Area (KMA) districts because of identified harvests of Upper Cook Inlet (UCI) sockeye salmon during the years 2014-2016.

EXECUTIVE SUMMARY

- The complexity within the existing UCI salmon management plans guiding management of the numerous fisheries far exceeds the quality, quantity and timeliness of the information available.

- Harvest estimates have far less uncertainty than do the variety of in season run strength projections and numerous escapement monitoring programs, especially the Susitna River escapement component.

- The Off-shore Test Fishery (OTF) run projections have errors around the estimates which are alarming (over projecting the actual run by 60%) given the reliance on this in-season tool within several prominent UCI management plans.

- Any proposed regulatory change to long established salmon fishery management plans must be able to demonstrate a measurable benefit; given poor data quality for specific UCI escapements or for certain in river run projections (Kenai R.), the information system currently in place is incapable of this task.

- When considering a system like the Susitna River, including the longstanding documented problems with estimating escapements, it is not prudent to affect adjacent management areas (e.g., Kodiak) with unnecessary changes.

- Considering the focus on coho salmon within the last three UCI board meetings (2011, 2014, 2017) and the conservative stipulations within the Northern District Management plan, if all of the sockeye incidentally caught in Kodiak were inserted into the UCI fishery mix, it would not have resulted in any benefit to Northern District coho stocks nor in-river users.

- Evaluating the commercial harvest of UCI stocks using a harvest rate metric would not be appropriate because of the uncertainty surrounding the escapement estimates of the Susitna River, Yentna River and other unassessed sockeye stocks.

Introduction

The identification and sporadic estimation of non-local stocks of sockeye salmon contributing to the sockeye harvest within the Kodiak Management Area has been completed using a variety of quantitative (scale pattern analyses and Genetic Stock Identification) and less quantitative (average weight and age proportions) techniques over the last 30 years. There does not appear to be temporal or spatial patterns or abundance-based trends of the contributing stocks, which suggests that the contributions are more random in nature (influenced more by environmental conditions: current, sea surface temperatures or broad scale climatic conditions). A common

acceptance is that fishing time in the various areas surrounding the Kodiak Archipelago targeting local stocks of sockeye, pink and chum salmon also contribute to these events. In a variety of ways one can characterize the Kodiak salmon fishery as a pass-through type fishery and the Upper Cook Inlet salmon fishery more of a gauntlet, where fish traverse through a variety of fisheries and gear types before reaching their natal streams or rivers.

Kodiak Fisheries Management plans

Area description

The Kodiak management area (KMA) includes all inland and marine waters (inside of 3 miles) south of Cape Douglas to Kilokak Rocks on the Alaska Peninsula and includes all islands within the Kodiak Archipelago. Within the area are 7 districts and 52 sections along with numerous subsections and terminal closed water areas. There are approximately 800 streams identified that have supported salmon spawning or rearing (Anadromous Waters Catalog), of which about 440 streams have been referenced as supporting measurable salmon production on an annual or biannual basis. Of the 440 systems, all support pink salmon, about 150 support chum salmon, 39 support sockeye salmon and about 175 support coho salmon populations (Clark et al. 2000). There are 593 Commercial Fisheries Entry Commission (CFEC) limited entry permits issued for the Kodiak area: 375 purse seine; 188 set gillnet; and 30 beach seine. Activity for each gear type fluctuates by year, with participation statistics for 2019 including 176 purse seine, 3 beach seine, and 148 set net permits having made at least one landing during the season.

Fishery Description

The Kodiak salmon fishery can be best described as a pass-through fishery, similar to Southeast Alaska fisheries. Pass through fisheries allow fish to reach terminal areas on their way to natal streams, where any type of fishery conducted is called a terminal fishery. Gear types participating in a pass-through fishery include set gillnet (fixed gear) and purse seine (mobile), which capture fish along their nearshore migration routes. Over time, and with the vigilance of salmon area management staff, fishing patterns, harvest magnitudes, and timing can be qualified and quantified with the goal of building information relative to run strength and migration timing by species and in many cases by specific stocks that contribute to the catch. The overall key to success of this salmon fishery management system is having specific, fixed geographic reference points, long standing accurate catch or harvest accounting, and an escapement enumeration and monitoring program for the major sockeye salmon producing systems that is conducted annually.

Management Plans

There are currently 10 salmon fishery management plans codified in regulation which prescribe how salmon fishing in each of the various districts, patterned after salmon species timing and historical fishing patterns, will be accorded. Two plans, including the Cape Igvak salmon management plan (effective prior to 1985; 5 AAC 18.360; Chignik Bound Sockeye) and the North Shelikof Strait Sockeye salmon management plan (effective 1990; 5 AAC 18.363: Upper Cook Inlet bound Sockeye), are tailored around sockeye salmon stocks destined for adjacent management areas (Chignik and Cook Inlet). The North Shelikof Strait plan was codified in 1990 following an out of cycle board of fisheries meeting that was specifically scheduled to address the unusual harvest of Cook Inlet Bound sockeye that occurred during 1988.

The remaining plans (Alitak District, Westside District, Eastside Afognak, Eastside, North Afognak/Shuyak Island and Mainland District) have been and are tailored towards meeting escapement objectives for each species using run timing and historical commercial fishing patterns, gear and areas. Other management tools include the use of subsections and a variety of

closed water areas around spawning streams (expanded or contracted) based on harvest numbers, aerial survey indices of abundance, and observed build ups of pre-spawning fish in marine staging areas. A multitude of fishery dependent and independent information is typically integrated into the inseason fishery management decision making process and in some cases these are daily decisions. As noted elsewhere, many of these management plans or the management philosophy contained within has been in existence since the late 1970s, and were systematically codified after numerous discussions within ADF&G and with commercial fishermen, processors, advisory committees, and finally with the Alaska Board of Fisheries during regularly scheduled meetings.

Upper Cook Inlet Fisheries Management Plans

Area Description

The Upper Cook Inlet (UCI) commercial salmon fishery management area comprises inland and marine waters of Cook Inlet north of Anchor Point Light. The area includes two districts (Central and Northern) with the Central District being 75 miles in length, 32 miles in width and divided into 6 subdistricts. The contemporary commercial fishing gear types allowed within the UCI are drift and set gillnet. There are approximately 1,300 commercial fishery entry permits within the UCI area, of which 570 are drift gillnet. Depending on a number of factors, the number of drift permit holders making landings in any given year ranges from 396-539 permits, which includes secondary permit holders operating in dual permit fishing operations (Farrington 2014). There are about 745 set gillnet permits issued for the area with about 500 permits making landings within any given year. Approximately 40-60 set gillnet permit holders are active within the Northern District set gillnet fishery.

Salmon fisheries management plans

There are 17 different plans that cover salmon fishing activities either directly or indirectly within the Upper Cook Inlet management area. Of the 17 plans, one deals with invasive northern pike within the Kenai R., two deal with riparian habitat protections; several govern subsistence (state or federal) fishing activities, and one that is novel to Cook Inlet: the personal use fishery management plan which is germane to fishing for sockeye salmon primarily on the Kenai and Kasilof Rivers. Graphical depictions of these complex and interdependent management plans are described during the 2008, 2011, 2014 and 2017 Alaska Board of Fisheries meetings, and can be found at the Board Support section of the ADF&G web page under the Board of Fisheries heading: www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.meetinginfo

Fishing Periods

In the Northern and Central Districts set gillnet fishery, two weekly 12 hour fishing periods are permitted on Mondays and Thursdays; in the drift gillnet fishery salmon may be taken within two weekly 12 hour fishing periods also on Mondays and Thursdays.

Central District Drift Gillnet Fishery Management Plan (5 AAC 21.353)

The stated purpose of this plan is to ensure adequate escapement into the Northern District drainages and offer management guidance to the department. The Board of Fisheries directs management of the drift fleet to minimize harvest of Northern District and Kenai River coho salmon, to provide sport and guided sport fishermen a reasonable opportunity to harvest these salmon stocks over the entire run, as measured by the frequency of in-river restrictions. In order to accomplish this task, from July 9-15 during the first and second regular fishing periods, drift fishing is restricted to the Expanded Kenai and Expanded Kasilof sections of the Upper Subdistrict and Drift Gillnet area 1. At run strengths greater than 2.3 million sockeye salmon to

the Kenai River, the commissioner may by emergency order open one additional 12 hour fishing period within the Expanded Kenai and Expanded Kasilof Sections of the Upper Subdistrict and Drift Gillnet Area 1; additional fishing time is only allowed in the Expanded Kenai and Expanded Kasilof Subsections of the Upper Subdistrict. From July 16-31 at Kenai River sockeye run strengths of less than 2.3 million, fishing during all regularly scheduled fishing periods will be restricted to the Expanded Kenai and Expanded Kasilof Sections of the Upper Subdistrict; at run strengths of 2.3-4.6 million sockeye salmon to the Kenai River, fishing during one regular 12 hr. fishing period will be restricted to one or more of the following sections or areas:… At run strengths greater than 4.6 million sockeye salmon to the Kenai River, one regular 12 hour fishing period per week will be restricted to the Expanded Kenai, Kasilof and Anchor Point Sections. From August 1-15, there are no mandatory area restrictions to the regular fishing periods with several caveats related to coho salmon destined for the Kenai River (see 5 AAC 21.353; p.347).

Northern District Salmon Management Plan (5 AAC 21.358)

The purpose of the Northern District Salmon management plan is to minimize harvests of coho salmon bound for the Norther District of UCI and to provide the department direction for management of salmon stocks. The department shall manage the chum, pink and sockeye salmon stocks primarily for commercial uses, to provide commercial fishermen with an economic yield from the harvest of these salmon resources based on abundance. The department shall also manage the chum, pink and sockeye salmon stocks to minimize the harvest of Northern District coho salmon, to provide sport and guided sport fishermen a reasonable opportunity to harvest these salmon resources over the entire run, as measured by the frequency of inriver restrictions. The department shall manage the Northern District commercial salmon fisheries based on the abundance of sockeye salmon counted through the weirs on Larson, Chelatna, and Judd Lakes or other salmon abundance indices as the department deems appropriate.

Kenai River Late-Run Sockeye Salmon Management Plan (5 AAC 21.360)

The department shall manage the Kenai River late-run sockeye stocks primarily for commercial uses based on abundance. The department shall also manage the commercial fisheries to minimize the harvest of Northern District coho, late-run Kenai king and coho salmon stocks to provide personal use, sport, and guided sport fishermen with a reasonable harvest opportunity.. The Kenai River late-run sockeye salmon commercial, sport and personal use fisheries shall be managed to meet an optimum escapement goal (OEG) range of 700,000-1,400,000 late-run sockeye salmon, achieve in-river goals as established by the board and measured at the Kenai River sonar counter located at river mile 19, and distribute the escapement evenly within the OEG range, in proportion to the size of the run.

Based on preseason forecasts and in-season evaluations of the total Kenai River late-run sockeye return during the fishing season, the run will be managed according to different run strength levels. At run strengths of less than 2,300,000 sockeye salmon, the department shall manage for an inriver goal range of 900,000-1,100,000 sockeye salmon past the sonar counter at river mile 19; subject to provisions of other management plans, the Upper Subdistrict set gillnet fishery will fish regular weekly fishing periods as specified in 5 AAC 21.320, through July 20, unless the department determines that the minimum in-river goal will not be met, at which time the fishery shall be closed or restricted as necessary; the commissioner may by emergency order, allow extra fishing periods of no more than 24 hours per week or per provisions in 5 AAC 21.365;

At run strengths of 2,300,000-4,600,000 sockeye salmon, the department shall manage for an inriver goal range of 1,000,000-1,200,000 sockeye salmon past the sonar counter at river mile 19; subject to provisions of other management plans, the Upper Subdistrict set gillnet fishery will

fish regular weekly fishing periods as specified in 5 AAC 21.320 through July 20, until the department makes a determination of run strength, whichever occurs first.
At run strengths greater than 4,600,000 sockeye salmon, the department shall manage for an inriver goal range of 1,100,000-1,350,000 sockeye salmon past the sonar counter at river mile 19; subject to provisions of other management plans, the Upper Subdistrict set gillnet fishery will fish regular weekly periods as specified in 5 AAC 21.320 through July 20, or until the department makes a determination of run strength, whichever comes first; if the department determines that the minimum in-river goal will not be met, the fishery shall be closed or restricted as necessary; the commissioner may, by emergency order, allow extra fishing periods of no more than 84 hours per week, except as provided in 5 AAC.21.365; and the Upper Subdistrict set gillnet fishery will be closed for one continuous 36-hour period per week, beginning between 7:00 p.m. Thursday and 7:00 a.m. Friday. The remaining elements of the plan relate to the inriver personal use and sport fishery.

Kasilof River Salmon Management Plan (5 AAC 21.365)

The bulk of this plan deals specifically with guidance on managing the commercial fishery for meeting the escapement goal as specified within the plan, however there are several sections that intersect with the Kenai River sockeye salmon: after July 15, if the department determines that the Kenai River late-run sockeye salmon run strength is projected to be less than 2,300,000 fish and the 390,000 optimal escapement goal for the Kasilof River sockeye salmon may be exceeded, the commissioner may, by emergency order, open fishing for an additional 24 hours per week in the Kasilof Section within one-half mile of shore and as specified in 5 AAC 21.360(c).

Additional Commercial Fishery Management Plans: *Cook Inlet Pink Salmon Management Plan (5 AAC 21.354); Kenai River Late-Run King Salmon Management Plan (5 AAC 21.359);Upper Cook Inlet Salmon Management Plan (5 AAC 21.363); Northern District King Salmon Management Plan (5 AAC 21.366).*

Sport Fishery Management Plans: *Russian River Sockeye Salmon Management Plan (5 AAC 57.150)***;** *Kenai River and Kasilof River Early-run King Salmon Management Plan (5 AAC 57.160);Kenai River Coho Salmon Management Plan (5 AAC 57.170); and the Upper Cook Inlet Personal Use Salmon Fishery Management Plan (5 AAC 77.540).*

Fishery Management Complexity

When comparing a number of fishery related metrics, complexity can be characterized by geographic scope, species richness, multiple overlapping objectives, and numbers of users/gear types/permits (human participation) which overlap a large geographic area, and in Cook Inlet, where most of the area is road or boat accessible and fishing occurs in either freshwater or marine waters. It could also be characterized by the number of regulatory proposals submitted to the Board of Fisheries' three-year regulatory cycle and emergency orders issued by the department each year. Determining a measure that captures allocative related issues such as regulatory proposals or agenda change requests (ACRs) is difficult, but there are many allocative elements interwoven within the Upper Cook Inlet fisheries and imbedded within the various salmon management plans.

Personal Use Fishery

Subsistence and personal use fisheries have undergone substantial changes within the Cook Inlet area over the last 20 plus years. There are four personal use fisheries that target primarily

sockeye salmon and collectively make up the bulk of the regulations embedded within the Personal Use management plan. The two major personal use fisheries operate adjacent to the Kasilof River, and adjacent to and within the lower portion of the Kenai River. Regarding the Kenai, retention of Chinook or king salmon has been prohibited for a number of years, owing to low production and concerns for meeting escapement goals. These two fisheries collectively are the largest participation fishery in Alaska. Over the last five years over 30,000 household permits have been issued and in several years the number of permits issued exceeds 35,000. During the years 2013-2015, average participation has been 27,850 household permits fished with an average sockeye salmon harvest of 494,115 per year (Dunker, 2018); the harvests of Kenai R. personal use sockeye salmon in 2014 and 2015 were 506,047 and 521,985 fish respectively. In 2016 the personal use fishery harvest was 264,900 sockeye salmon.

Kenai River Sport/Recreational Fishery

This fishery is arguably the largest sport/recreational fishery in Alaska with participation statistics, measured in angler days, ranging from 365,000-485,000 days annually. Sport fishing effort is spread throughout the drainage; however, a majority of the effort is concentrated below the Soldotna Bridge to tidewater. The annual recreational harvest of sockeye salmon occurs both above the sonar counting station at river mile 19 and below with an average of 20% of the harvest occurring below the counting station. The average (2011-2015) annual harvest of sockeye salmon is 422,480, of which 86,920 fish are harvested below the escapement enumeration or sonar site. The 2014 sockeye salmon harvest was 380,055 and for 2015 it was 392,116 fish (Begich et al. 2017). The recreational harvest for 2016 was 342,446 sockeye salmon.

When combined (personal use and in-river sport), the harvests have averaged 688,676 sockeye salmon annually (2014-2017; ADF&G personal communication). The Kenai River sockeye salmon escapement over these years has ranged from 1,400,047 in 2015 to 1,073,290 fish in 2017 and averaged 1,203,125 fish (Table 1.)

Fishery Management Data Sources

Escapement monitoring

Escapement has been assessed using side-scan sonar for a lengthy time period for the Kenai and Kasilof rivers and has incorporated modern gear (Bendix to DIDSON to now ARIS technology). The counts are generated daily and employed to evaluate escapement relative to fishery management decisions. There have not been any independent verifications of either the Kenai or Kasilof sonar escapement estimates. When converting to modern technology, the Bendix and DIDSON sonar systems were determined to offer almost identical escapement passage estimates for the Kasilof River, but that the Bendix system for the Kenai system generated escapement estimates that were substantially less that the estimates generated by the DIDSON system. This was also the case for the Yentna River (Maxwell et al. 2011). This information was integrated into a conversion from BENDIX to DIDSON units for the Kenai River sockeye salmon escapement, such that historical and contemporary escapement numbers were consistent.

For the Yentna River, the use of sonar to enumerate escapement was discontinued in 2008 due to the considerable uncertainty associated with the estimates (Fair et al. 2009). The current escapement monitoring program consists of counting weirs on Chelatna and Judd lakes. Similarly, for the Sustina River, a counting weir at Larson Lake is employed as an index of the Susitna River mainstem escapement. Fair et al. (2009), as a means to estimate total drainage wide escapement for the Yentna and Susitna rivers sockeye salmon stocks, employed the relationship between weir counts and a series of mark-recapture estimates to expand the weir

counts into drainage wide estimates. The identified relationships include Larson Lake weir counts accounting for 50-54% of the drainage wide mark-recapture estimates generated for 2006-2008. For the Yentna River, the relationship between the weir counts and the mark-recapture estimates ranged from 41-44% for Chelatna and Judd lakes combined. This approach certainly seems reasonable, however there is quite a bit of uncertainty about carrying this relationship forward to estimate total escapement for these drainages, especially when accounting for differential productivity that can occur with sockeye salmon populations between adjacent years, and also employing mark-recapture estimates which have their own set of assumptions and challenges.

There are numerous sockeye producing systems within Cook Inlet that have no monitoring programs, but that production contributes to the overall harvest. Shields (2010), within the annual management report, cites that the contribution of these unmonitored systems was projected to contribute upwards of 13% (835,000 fish from a total run of 6,404,000) to the Upper Cook Inlet harvest with an unknown level of escapement.

Barclay (2017) reported that for the years 2014-2016 that the unreported harvest (catch that could not be assigned to one of the predetermined sockeye stock groupings within UCI) represented 9.5% (223,106; 2014), 5.2% (138,826 fish) for 2015 and <0.1% (15,518 fish) in 2016. These findings are not uncommon with mixed stock analyses when dealing with many stocks and in most cases for small stocks. Shedd et al. (2016) aptly discusses this routine challenge by stating "Additionally, it is necessary to recognize that even with fishery samples of 380 fish per stratum, it is challenging to estimate small proportions in a mixture". Based on these recognized analytical difficulties, and the stated uncertainties regarding escapements for several Upper Cook Inlet sockeye stocks, the most prudent way to evaluate estimates of non-local stock harvest is to compare harvest or proportions of the harvest. The harvest, whether it is commercial (fish ticket receipts), recreational (Statewide Harvest survey) or personal use (household permit record) is likely the most certain source of data that managers have available to them.

Offshore Test Fishery (OTF; 2014-2017)

One of the most important data sources for UCI in-season management, given the wide array of objectives dictated by regulations promulgated by the Alaska Board of Fisheries within the last 10 years, is the offshore test fishery (OTF) which was initiated in 1979. Many of the plans and subsequent regulation changes have requirements specifically related to inseason abundance estimates. These projections are employed to make in-season management decisions attempting to meet escapement objectives for Susitna bound sockeye stocks, and for sockeye destined for the Kenai and Kasilof rivers as well. The Kenai River late-run sockeye salmon management plan and attendant prescribed fishing times for the drift and set gillnet fisheries rely heavily on this estimate, based on a multi layered tier system.

2014

The midpoint of the 2014 sockeye salmon run at the OTF occurred on July 16 (point at which 50% of the run is projected to be past the OTF). There were two formal inseason estimates of the 2014 run size made on July 21 and 23; the 23 July analysis predicted a total run of 5.8-9.1 million sockeye salmon. The best fit total run estimate deviated from the actual run of 5.28 million fish by 72% or a difference of 3.82 million fish. The best fit Kenai river total run estimate from this analysis (5.65 million) differed from the actual total run of 3.28 million fish also by 72%, representing a difference of 1.83 million fish (Dupuis et al. 2016).

2015
The midpoint of the 2015 sockeye salmon run at the OTF occurred on July 25. A formal in-season estimate of run size was made on July 27 and predicted a total run to Upper Cook Inlet of 5.9 million sockeye salmon. The best-fit total run estimate deviated from the estimated total run of 6.30 million by 6.5% (400,000 fish). An in-season estimate was also made for the Kenai River sockeye salmon run on July 27; the analysis predicted a total run to the Kenai River ranging between 2.20-3.53 million sockeye salmon. The best-fit total run estimate of Kenai River sockeye salmon was 3.53 million which deviated from the estimated total run of 3.89 million fish by 9.3% (360,000 fish; Dupuis and Willette, 2016).
2016
The midpoint of the 2016 sockeye salmon run at the OTF occurred on July 18. An in-season estimate of the 2016 run was generated on July 25 and predicted a total run to Upper Cook Inlet (UCI) of 6.83 million sockeye salmon. The best-fit model estimate varied from the total run estimate of 5.11 million by 33.7% or 1.72 million fish. The inseason estimate for Kenai River sockeye salmon was made on July 25 with an estimate of 3.53-5.57 million fish with a post season estimate of 3.55 million sockeye. Managers employed a run estimate of 4.6 million fish, an overestimate of 29.5% (1,050,000 fish; Dupuis and Willette 2018).
2017
The midpoint of the sockeye salmon run in 2017 at the OTF was July 20; a formal estimate of the run was generated on July 24 with a prediction of 7.11 million fish. The first best-fit total run prediction was 54.2% higher than the actual total run of 3.85 million (difference of 3.26 million fish). An in-season estimate for the Kenai River sockeye run was made on July 24 resulting in an estimate of 1.6-4.3 million sockeye (actual post season estimate was: 2.89 million or 44.5% (1.29 million fish below actual), or conversely 48.7% higher than actual. Regardless of which direction the error is evaluated, it was substantial (about 1.3 million fish; Frothingham and Willette 2018).

Synthesis of information

- Using an average 2014-2016 Kenai R. commercial harvest rate (catch/catch+escapement) of 57.1%, the following would be the fate of 75,000 hypothetical sockeye that enter UCI destined for the Susitna/Yentna Rivers combined: 23,982 fish would become drift gillnet harvest, 18,843 fish would become set net harvest, 3,854 harvested fish would be assigned to an unreported stock group, 9,750 sockeye would escape to unmonitored streams, and 18,571 fish would make it to the Susitna/Yentna Rivers, of which a total of 9,000 sockeye would be potentially counted at Judd, Chelatna or Larson lake weirs. The potential benefits (escapement or harvest to UCI users) would be undetectable amidst the large total harvests and monitored escapements in Upper Cook Inlet.

- The complexity of existing UCI salmon management plans far exceeds the quality, quantity and timeliness of the information available. Management staff in the department do a surprisingly successful job managing these fisheries and meeting escapement goals and objectives given the data available and estimate uncertainty.

- Estimates of harvest have far less uncertainty than do the variety of in season run strength projections or data from the numerous escapement monitoring programs,

especially the Susitna River escapement component. Therefore, the harvest estimates for UCI bound sockeye that were incidentally taken in Kodiak should be compared to the total harvest of UCI sockeye.

- In 2014, there were an estimated 58,506 sockeye salmon harvested within the KMA of Cook Inlet origin (Kenai and Susitna stocks) from a total UCI harvest of 3,360,383 or 1.7%;
- In 2015, an estimated 438,433 Kenai and Susitna fish were harvested in the KMA versus the total harvest of 3,694,270 sockeye in the UCI or 11.8%;
- In 2016, 309,497 UCI (Kenai and Susitna stocks) sockeye were identified within the Kodiak catch compared to a total UCI sockeye harvest of 3,095,833, or 10.0%.

- The OTF run projections have errors around the estimates that are alarming (over projecting the actual run by 60%) given the reliance on this in-season tool within several prominent management plans; the Kenai R. sockeye run projection placed the run in the wrong management tier 2 out of 4 years (2014, 2016) thus allowing for increased fishing time for the drift gillnet fleet.

- Any proposed regulatory change to long established salmon fishery management plans must be numerically measurable. Given poor data quality for specific escapements or to certain in-river-runs (Kenai R.) the information system currently in place is incapable of this task, even if harvests within the KMA were twice those that are currently estimated.

- Certainly, for a system such as the Susitna River with all of its documented longstanding problems in obtaining reliable and annual escapement estimates, is it not prudent to reach out and affect an adjacent management area. Currently, in order to generate Susitna River escapement estimates, the weir count (known escapement numbers) is multiplied by a constant derived from a mark-recapture study conducted for 3 three years that is now over 10 years old. Because of this unreliable method, the Susitna and Yentna Rivers escapement estimates should be treated as informative but certainly not known.

- Given the focus on coho salmon within the last three UCI board meetings (2011,2014, 2017), and the conservative stipulations within the Northern District management plan, if all of the sockeye incidentally caught in Kodiak were inserted into the UCI fishery mix, it would not have resulted in any beneficial impact to Northern District coho stocks nor in-river users. Coho salmon run strength is based on fishery performance (commercial and in-river sport) and not demonstrable escapement estimates.

- Evaluating the commercial harvest of UCI stocks using a harvest rate metric would likely be erroneous, owing to the uncertainty surrounding the escapement estimates of

the Susitna River, Yentna River and other unassessed sockeye stocks. These stocks contribute to the harvest, but escapement to these systems is unknown or indexed, not counted.

References:

Begich, R.N., J.A. Pauluk, J.L. Cope and S.K. Simmons, 2017. 2014-2015 Annual Management Report and 2016 Sport Fisheries overview for Northern Kenai Peninsula: Fisheries under consideration by the Alaska Board of Fisheries, 2017. Alaska Department of Fish and Game, Fishery Management Report No. 17-06, Anchorage.

Barclay, A.W. 2017. Annual Genetic Stock Composition Estimates for the Upper Cook Inlet Sockeye Salmon Commercial Fishery, 2005-2016. Alaska Department of Fish and Game, Regional Information Report 5J17-05, Anchorage.

Clark, J.H., A. McGregor, D. Mecum, P. Krasnowski, and A. Carroll. 2006. The Commercial Salmon Fishery in Alaska. Alaska Department of Fish and Game, Fishery Research Bulletin, Vol.12 No.1, Juneau.

Dunker, K.J. 2018. Upper Cook Inlet Personal Use Fisheries, 2013-2015. Alaska Department of Fish and Game, Fishery Data Series No. 18-10, Anchorage.

Dupuis, A. T. M. Willette and A. Barklay, 2016. Migratory Timing and Abundance estimates of Sockeye Salmon to Upper Cook Inlet, Alaska, 2014. Alaska Department of Fish and Game, Fishery Data Series No.16-43, Anchorage.

Dupuis, A. and T.M. Willette, 2016. Migratory Timing and Abundance Estimates for Sockeye Salmon in Upper Cook Inlet, Alaska, 2015. Alaska Department of Fish and Game, Fishery Data Series No.16-53, Anchorage.

Dupuis, A. and T.M. Willette, 2018. Migratory Timing and Abundance Estimates for Sockeye Salmon in Upper Cook Inlet, Alaska, 2016. Alaska Department of Fish and Game, Fishery Data Series No.18-23, Anchorage.

Fair, L.F, T.M. Willette, and J.W. Erickson. 2009. Escapement goal review for Susitna River sockeye salmon, 2009. Alaska Department of Fish and Game, Fishery Manuscript Series No.09-01, Anchorage.

Farrington, C., K. Iverson and M. Gho, 2014. Dual-permit Fishing Operations in the Cook Inlet Salmon Drift Gillnet Fishery. Commercial Fishery Entry Commission, CFEC Report 14-6N, Juneau.

Frothingham, A. and T.M. Willette, 2018. Migratory timing and Abundance Estimates for Sockeye Salmon in Upper Cook Inlet, Alaska, 2017. Alaska Department of Fish and Game, Fishery Data Series No. 18-24, Anchorage.

Maxwell, S.L., A.V. Faulkner, L.F. Fair, and X. Zhang. 2011. A Comparison of Estimates from 2 Hydroacoustic Systems Used to Assess Sockeye Salmon Escapement in 5 Alaska Rivers. Alaska Department of Fish and Game, Fishery Manuscript Series No.11-02, Anchorage.

Shedd, K.R, T.H. Dann, H.A. Hoyt, M.B. Foster and C. Habicht, 2016. Genetic Baseline of North American Sockeye Salmon for Mixed Stock Analyses of Kodiak Management Area Commercial Fisheries, 2014-2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-03, Anchorage.

Shields, P. 2010. Upper Cook Inlet Commercial Fisheries Annual Management Report, 2010. Alaska Department of Fish and Game, Fishery Management Report No.10-54, Anchorage.

Kodiak Seiners Association
PO Box 8835
Kodiak, AK 99615

December 24, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: **Oppose Proposal 64**

Dear Chairman Morisky and Board of Fish Members:

Thank you for the opportunity to comment on **Proposal 64**. The Kodiak Seiners Association (KSA) respectfully requests you **oppose proposal 64**, which intends to impose onerous and arbitrary restrictions to our commercial fishery through the creation of "seaward" and "shoreward" harvest zones in the mainland district of Kodiak.

This proposal represents and perpetuates an amalgamation of misconceptions concerning the salmon fishery in the Kodiak Management Area (KMA). First and foremast is the implication that Kodiak currently bears no burden of conservation of Cook Inlet (CI) stocks and that we are essentially operating in the absence of regulations that substantially restrict harvest. The North Shelikof Straight Management Plan was established with the intention of annually limiting the harvest Cook Inlet bound sockeye regardless of run strength. This means that on years of abundant CI stocks higher harvest rates trigger early closures of the seaward zones which then remain closed until July 25th, depriving the fleet of substantial fishing opportunity in an effort to conserve a fishery that is chronically under-harvested while also inhibiting the harvest of our local stocks.

Additionally, the Mainland District, which includes the Cape Igvak section, is the most stringently managed area in the KMA during the time of consideration for this proposal. Kodiak fishermen are only allowed a maximum of four 57-hour openings in the mainland district before August 1st. These openings cannot be extended regardless of the abundance of local and non-local stocks. The Wide Bay section does not open before July 25th, and it is not unusual for the Cape Igvak section to remain closed until July 25th as well, long after the peak of the late Chignik and Cook Inlet sockeye runs. There is no other district in the KMA that is so rigidly managed during this time frame, and the current management structure already provides insufficient opportunity to harvest local stocks.

The Board should also consider that the structure of the Cape Igvak management plan inherently acts to conserve CI stocks on the rare occasion that they are harvested there. Although the harvest

allocation for Igvak is set according to measures of abundance in Chignik, the harvest of any stocks counts against that allocation and will trigger a closure. Consider the anomalously high harvest rates of 2016. An abundance of what we now know were Cook Inlet stocks that were perplexingly swimming westward led to unusually high harvest rates, quickly triggering a closure of the Cape Igvak area which then remained closed for the rest of the season. Kodiak fishermen are always operating under strictly imposed harvest quotas at Igvak and these harvest caps apply regardless of the stock composition. For that reason, Igvak especially and the rest of the mainland in general are currently managed under a structure that provides maximum safeguards to CI stocks and minimal opportunities to harvest local stocks while prosecuting our traditional fishery.

Another glaring falsehood stated in this proposal is the claim that the KMA only has 7 streams with sockeye present. Kodiak has, in fact, 15 un-enhanced streams that are common sources of commercial harvest in addition to 4 major enhancement systems with associated terminal harvest areas. There are additionally numerous other minor wild systems and subsistence enhancement projects that contribute to mixed stock sockeye harvest in the KMA. A list of important sockeye systems that contribute to mixed stock harvest throughout the KMA is provided below:

Non-Enhanced (Wild) Systems	**Enhanced Systems**
1) Karluk 2) Ayakulik 3) Frazer 4) Upper Station 5) Dog Salmon 6) Saltery 7) Pasagshak 8) Buskin 9) Litnik 10) Pauls Bay 11) Discovery Bay 12) Thorsheim 13) Malina Creek 14) Uganik 15) Kaflia	1) Spiridon 2) Kitoi 3) Foul Bay 4) Waterfall Bay

Typical aggregate escapement numbers for these systems exceeds 1.5 million sockeye annually, and enhancement projects can contribute hundreds of thousands additional sockeye for harvest. These fish are widely distributed in the KMA both geographically and temporally, and sockeye bound for KMA systems are harvested throughout the season and in all districts, including the mainland district. It is unclear how the proposer concluded that Kodiak has only 7 sockeye runs only 2 of which are "of minor production status." In reality, 9 of Kodiak's rivers have weirs counting sockeye, and aerial surveys are common for numerous other systems, like Uganik.

It is our hope that the Board understands that the majority of sockeye harvested in Kodiak are of local origin and that our fisheries are responsibly prosecuted as directed harvest of local stocks of sockeye, chum, pink, and coho salmon along with our historical and traditional harvest allocation at Igvak.

One of the most frustrating gaps in the greater public understanding of the mixed stock fishery in Kodiak is that we are prosecuting a mixed-stock, multi-species fishery. The recent publication of the genetic stock assessment focused public attention exclusively on the sockeye component of commercial harvest, while neglecting to provide harvest figures for the non-sockeye portion, which comprises the vast majority of fish harvested in Kodiak. For example, sockeye made up only about 6% of the fish harvested in the KMA in 2019, and even in July, during the period of concern for this proposal, Kodiak harvest was overwhelmingly pink and chum salmon. Efforts to curtail the harvest of sockeye in Kodiak, especially CI stocks which exhibit no predictable migration patterns in the KMA, would inevitably result in significant collateral damage in the form of lost harvest of local, pink, chum, and coho stocks that are largely the focus of our directed fishery.

This very situation highlights the fundamental reason why the Alaska Board of Fisheries adopted a mixed stock fisheries policy. Migrating salmon do not conveniently segregate themselves by species and stocks of origin, and they do not embark on predictable migration paths far away from their natal streams. As a result, non-local mixed stock harvest of salmon is inevitable in all Alaskan waters and attempts to manage our fisheries in order to somehow distill out non-local components will inevitably result in sub-optimal use of the resource.

The Mixed Stock Fisheries policy and its associated findings resulted from the acceptance that Alaska must manage its fisheries in a way that best complies with Article VIII of the Alaska state constitution which declares that, "Wherever occurring in the their natural state, fish…are reserved to the people for common use" and that fishery resources be "utilized, developed and maintained on the sustained yield principle" and finally that uses of the resource is available for "maximum use" and for the "maximum benefit" of Alaskans.

The purely allocative proposals offered to the Alaska Board of Fisheries for this meeting would inevitably result in reduced yields of local stocks in addition to massive disruption of a long-established traditional fishery. If the Board were to apply the same reasoning presented in this proposal to management regimes throughout the state, then the net result would be to forsake the sustained yield principle as well as other constitutional statutes and Board policies. The uniform application of the reasoning found in Proposal 64 would inflict substantial economic losses for the state and most acutely for Alaska's coastal fishing communities. Ultimately, managing our fisheries for the maximum benefit and sustained yield standards means that we must accept that the unpredictable nature of salmon migration negates the unrealistic standard of purely localized harvest.

Although some user groups may lament the faraway harvest of what they consider to be *their stocks,* the policies that allow for this harvest were crafted with immense consideration of how to develop consistent management plans that when universally applied maximize the use of the resource and the benefit conveyed to Alaskans. Although it may seem intuitive to some that it is somehow inherently unfair for Kodiak fisherman to harvest Cook Inlet stocks, the Board should consider whether it would be fair for those same fishermen to sacrifice the harvest of hundreds of local fish

in order to potentially provide Cook Inlet waters with a single additional salmon from chronically under-harvested stocks.

Ultimately, Alaska's fisheries are dedicated for common use, and wholesale regional entitlement, which is asserted in this proposal, would violate the very foundational principles of our constitution. Although KSA strongly believes that subsistence users should be granted ultimate priority, there would be no value conveyed to the state by attempting to disrupt a historical fishery just to alter the geographic location of commercial harvest. There are no Board policies or legal statutes that direct managers to ensure commercial harvest be focused exclusively in the region of natal streams. As long as an established commercial fishery alone does not intrinsically threaten the biological sustainability of stocks or the ability to provide subsistence harvest opportunities, then that fishery should not be disrupted simply to regionally reallocate commercial harvest.

Additionally, the Board should consider the importance of consistency in the application of their policies. Currently, Kodiak fishermen bear the sole burden of conservation of KMA stocks despite the documentation of substantial harvest of "East of WASSIP" stocks in Chignik and further south. While KSA is strongly ideologically opposed to meddling in the management of fisheries in adjacent areas, we also believe that whatever standards are applied *to* our fishermen must also be applied *for* our fishermen so that any further restrictions on harvest in the KMA designed to prevent the catch of non-local stocks must be coupled with restrictions to the south designed to prevent the unregulated harvest of KMA and Cook Inlet bound stocks in the Chignik management area and wherever else these fish may be present. After all, the legitimacy of the Board's reasoning is critically and inextricably dependent on the consistency with which its policies are applied.

KSA respectfully requests that you **oppose proposal 64** and support the responsible application of the Mixed Stock Fisheries Policy in Kodiak. We believe that adopting this proposal would result in substantial and irreversible economic harm to our fleet and the economy of communities of Kodiak and that the spirit and intent of the proposal are in complete violation of the state constitution and other adopted Board policies.

Kodiak Seiners Association represents 157 members, including the majority of actively fishing SO1K seine permit holders, Kodiak and Homer-based businesses, and individual crewmembers. Our focus is advocacy for our membership through positive interactions with ADF&G, the Board of Fisheries, and our State Legislature.

Sincerely,

Nate Rose
KSA President

December 24, 2019

Matthew Alward

60082 Clarice Way

Homer, AK 99603

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: Opposition to proposal 64

Dear Chairman Morisky and board of fisheries members,

I reside in Homer, AK and support our family fishing our own boat in the Kodiak salmon seine fishery and I oppose proposal 64 which would create new time and area restrictions in the mainland district. I raised our kids on the back deck and an important part of that was the mainland fishery.

Proposal 64 seeks to create "seaward" and "shorward" zones in the mainland district with the seaward zone restricted to two 12 hour fishing periods per week form June 28th to July 25th. The justification stated for this proposal is that "a recent genetic study exposed some incorrect assumptions on Sockeye stock composition in the Kodiak Management Area". The Kodiak Sockeye genetic stock composition study that the proposer is referring to in fact did not take any samples from the mainland district north of the Cape Igvak section and only sampled one year in Cape Igvak section so there is no data that could of exposed incorrect assumptions on sockeye stock composition in over two thirds of the mainland district. This proposal simply makes assumptions with no data to back them up and asked to create prescriptive time and area closures based on those assumptions.

During July there is many local chum and pink salmon runs in the mainland district and if enacted this proposal would make it hard for managers to manage the harvest of these local stocks. This proposal is assuming that the mainland district fishery is a sockeye only fishery when in fact it is a mixed salmon species stock fishery as well and gives no regard of this fact.

In closing given the fact that there is no sockeye harvest genetic data for over two thirds of the mainland district as well as the fact that there is also chum and pink salmon stocks present I respectively ask that you don't create prescriptive management restrictions and oppose proposal 64.

Sincerely,

Matthew Alward

Michelle Rittenhouse
PO Box KWP
Kodiak, AK 99697

December 18, 2019

Chairman Reed Morisky
Alaska Board of Fisheries
Board Support Section
PO Box 115526
Juneau, AK 99811-5526

RE: Proposal #64

Dear Chairman Reed Morisky and Board of Fish Members:

I am a 3rd generation commercial fisherman from Kodiak, AK. I have been an active participant in Kodiak's salmon fishery for 23 of my 32 years, working alongside my family as crew until I purchased my own vessel, which I have been operating since 2013. As a young business owner heavily invested in especially the Kodiak salmon fishery, and whose livelihood is solely based on fishing, I consider this proposal a serious threat to my ability at making a living. I respectfully ask that the Board reject proposal #64.

The Kodiak management plan has a longstanding history for being tried and true. It has been well-constructed to prevent conservation issues to other fishing areas and salmon stocks of non-local origin. It is a known fact that salmon runs are cyclical in nature, experiencing highs and lows in returns, and to blame Kodiak fishermen for the lack of salmon returns to other areas is a baseless argument with negligible evidence to support it. My reliance on getting as much fishing time as possible during the salmon season in Kodiak continues to grow heavier, as other options I explore, such as longlining for halibut and Pacific gray cod fisheries continue to diminish in stock. It is difficult enough to survive the normal ups and downs our fisheries, much less make changes to Kodiak's management plan that will forever negatively impact my ability to pay off my fishing operation. Commercial fishing is not only my livelihood, but also my passion, and I would like to continue doing it for many years to come.

Again, I respectfully request that the Board of Fish reject Proposal #64. Thank you for giving me the opportunity to comment, and for your time. I hope the Board continues to apply consistency in its application of the guiding policies such as the Mixed Stock Fisheries Policy and the Sustainable Fisheries Policy.

Most sincerely,
Michelle Rittenhouse

Mike Ferris
F/V Cally Rose
12/13/2019 10:27 PM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

Hello my name is mike Ferris born & raised Kodiak resident & commercial fisherman, I've been involved in Kodiak salmon since 1987 when I was 10yrs old I ran my first seiner on my own in 1999. Took a few years off of skippering but have been active none the less have run tenders & crewed. This proposal is not only out of line but totally be devastating to Kodiak as a community As a whole the current laws in place are proven to be effective & more than efficient proven for 30 yrs no change is needed! Please don't change a working and in place management plan. Thank you Mike Ferris Kodiak Ak,

Nicholas Hoffman
PO Box 1212
Kodiak, AK 99615

12/24/19

Chairman Reed Moriskey
Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: Oppose Proposal 64

Dear Chairman Morisky and Board of Fish members:

I'm a young Kodiak salmon fisherman. I have been running a seine boat since 2011 as well as participating in Kodiak halibut, sea cumber, cod jig, and tanner crab fisheries. I respectfully request the Board reject Proposal 64.

This proposal is based on extremely limited data. The data is from only a few days in 2016. This was a fluke year when weather patterns pushed fish around in a huge storm. If fishing regulations are to be rewritten, the changes should be based on thorough studies using multiple years of data, not based solely on one exceptional year. Even this limited study showed nothing new, only confirmed something everyone already knows: Cook Inlet bound fish swim through Kodiak waters. According to the Constitution of the State of Alaska, Article 8, Section 3, “fish, wildlife, and waters are reserved to the people for common use.” This proposal seeks to favor one area over another demanding that Kodiak be limited in favor of Cook Inlet which is several hundred miles away. This is not a conservation issue, but simply Cook Inlet's fishermen trying to limit a neighboring fishery.

The Kodiak Management Plan is a solid mixed stock management plan that works well to balance the needs of the different species of salmon in Kodiak and already has controlled safeguards for the interception of Cook Inlet fish in the North Shelikof Strait Management Plan.

This is an allocation issue for Cook Inlet that if allowed to go forward would limit Kodiak's ability to fish our local stocks.

I see no reason for the Board to make any changes to the Kodiak Salmon Management plan. Thank you for the opportunity to comment on the proposals and the chance for my voice to be heard. I look forward to the Board of Fish members getting to spend time in Kodiak and learn more about our town and fishing community.

I humbly request the Board reject Proposal 64.

Sincerely,

Nicholas Hoffman
F/V Relentless

Oliver Holm
self
12/27/2019 03:26 PM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

I oppose this proposal because it pretends that the only reason to be fishing on the mainland side of the straights is for sockeye. In July there are significant local stocks of chum and pinks to be caught. The presence of Cook Inlet sockeye in July is highly sporadic and there isn't a valid reason to adjust the existing fishery to avoid them. The board of fish has already addressed what was an expanded effort in the north Shelikof and extending it south and arbitrarily changing the seaward zone times is not justified under the Board's mixed stock fisheries policy or the allocation policy.

December 24, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 64

Dear Chairman Morisky and Board of Fisheries Members,

I am Richard Roth, Kodiak salmon purse seine permit holder. Thank you for the opportunity to comment on proposals for the Kodiak finfish meeting. My wife three children and I reside in Homer, but fish in Kodiak. I own and operate the F/V Sea Tzar. We rely solely on salmon seining for our livelihood and annual income to support our business, our family and contribute to our Alaskan economy through business and personal expenditures.

The author of this proposal is citing a genetic study showing nothing new, simply a confirmation of something already known – that Cook Inlet origin sockeye sometimes swim through Kodiak waters. There are measures already in place (such as the North Shelikof Management Plan) that address this, to ensure that the vast majority of Cook Inlet- bound sockeye that do swim the Shelikof, make it through. Placing a cape to cape line on the mainland would keep Kodiak-area managers from maintaining the stability of local pink, silver, and chum salmon and raise serious concerns and precedents about the underlying foundation of common property fisheries in the State of Alaska.

Instead of an attempt to restructure the fisheries in a neighboring region, the Board's time would be better spent investigating the number of years the Kenai and Kasilof rivers have exceeded their escapement, and yet Cook Inlet drift-gillnetters and set-gillnetters still have minimal fishing time when in other regions there would be emergency openings to maintain the health of fish stocks and the rivers. For example, 2019 was a banner year, and yet commercial fishermen were forced to sit on their hands while the Kenai and Kasilof rivers were over-escaped by the hundreds of thousands.

The Kodiak Management Plan is a solid plan that has a proven working track record. The author appears to have little care for the success and sustainability of the management plan in our region and how it allows for the harvesting of local sockeye, pinks, silvers and chums.

I wish all the best to the user-groups of the Cook Inlet Region and hope that in the near future the user groups and management will be able to work together for more peaceful fisheries and sustainable and strong runs in that region.

I strongly encourage the Board to reject this proposal.

Thank you for your careful consideration,

Richard, Amanda, Stephanie, Noah, and Ranger Roth
F/V Sea Tzar
Homer, AK

December 19, 2019

Robert Fellows

266 E Bayview Ave.

Homer, AK. 99603

Alaska Board of Fisheries

Board Support Section

PO Box 115526

Juneau, Ak. 99811-5526

RE: Opposition to proposal 64

Dear chairman Morisky and Board of Fisheries members,

I am a Homer resident who makes a living for my family and crewmembers in the Kodiak commercial salmon fishery. My family, crewmembers, and their families depend on this fishery for the majority of our yearly income. I have commercially fished salmon in the Kodiak area for 29 years. This proposal would drastically affect my ability to continue making a living fishing for salmon. I respectfully request the Board reject proposal #64

The events that led to the harvest percentages that showed up in the 2016 genetic study were unusual. This in turn led to those harvest percentages being an anomaly, not the norm. This proposer is trying to say that there is a problem of Cook Inlet bound sockeye being harvested in the Kodiak management area. The information cited in this proposal came out of a genetic study done in 2016. The proposer is taking that information out of context. That study only indicates what the harvest make-up was in that particular year and only on the dates sampling took place. To be scientifically valid the study would have to be conducted over several years in a row to show any kind of trend in harvest make-up. The study shows nothing new. Occasionally Cook Inlet bound sockeye salmon are harvested in the Kodiak area as they swim through.

Placing a cape to cape line in the mainland district would extremely limit the ability of Kodiak fishermen to harvest local pink and chum salmon runs. It would hamper the departments ability to properly manage these local runs. The Kodiak area management plan is long standing with a good working track record. Targeted harvest of Cook Inlet bound sockeye salmon ended in 1989 with the creation of the North Shelikof Sockeye management plan. The proposer has no understanding of how the current management plan works and allows for harvest of local sockeye, pink, and chum salmon runs. The proposer is making a huge false assumption that the unusual harvest of Cook Inlet sockeye salmon that occurred in 2016 happens every year. What the proposer doesn't mention is the documented over escapement into the Kenai river system that does occur every year. The proposer is grasping at any idea that they think might put more fish into the Cook Inlet management area. It appears that those surplus fish have already been getting there and they end up in the Kenai River.

Sincerely,

Robert Fellows

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

December 24, 2019 Alaska Board of Fisheries Board Support Section P.O. Box 115526 Juneau, AK 99811-5526 Re: Opposition to Proposal 64 Dear Chairman Morisky and Board of Fisheries Members, I am Steve Roth, Kodiak and Lower Cook Inlet salmon purse seine permit holder. Thank you for the opportunity to comment on proposals for the Kodiak finfish meeting. My wife and I reside in Homer, but fish in Kodiak. I own and operate the F/V Sea Grace. We rely solely on salmon seining for our livelihood and annual income to support our business, our family and contribute to our Alaskan economy through business and personal expenditures. ? The author of this proposal is citing a genetic study showing nothing new, simply a confirmation of something already known – that Cook Inlet origin sockeye sometimes swim through Kodiak waters. There are measures already in place (such as the North Shelikof Management Plan) that address this, to ensure that the vast majority of Cook Inlet- bound sockeye that do swim the Shelikof, make it through. Placing a cape to cape line on the mainland would keep Kodiak-area managers from maintaining the stability of local pink, silver, and chum salmon and raise serious concerns and precedents about the underlying foundation of common property fisheries in the State of Alaska. Instead of an attempt to restructure the fisheries in a neighboring region, the Board’s time would be better spent investigating the number of years the Kenai and Kasilof rivers have exceeded their escapement, and yet Cook Inlet drift-gillnetters and set-gillnetters still have minimal fishing time when in other regions there would be emergency openings to maintain the health of fish stocks and the rivers. For example, 2019 was a banner year, and yet commercial fishermen were forced to sit on their hands while the Kenai and Kasilof rivers were over-escaped by the hundreds of thousands. The Kodiak Management Plan is a solid plan that has a proven working track record. The author appears to have little care for the success and sustainability of the management plan in our region and how it allows for the harvesting of local sockeye, pinks, silvers and chums. I wish all the best to the user-groups of the Cook Inlet Region and hope that in the near future the user groups and management will be able to work together for more peaceful fisheries and sustainable and strong runs in that region. I strongly encourage the Board to reject this proposal. Thank you for your careful consideration, Steve and Jenny Roth? F/V Sea Grace Homer, AK

Tyler-Rose Hoffman
PO Box 1212
Kodiak, AK 99615

12/24/19

Chairman Reed Moriskey
Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: **Oppose Proposal 64**

Dear Chairman Morisky and Board of Fish members:

I live in Kodiak and my husband and I operate a commercial fishing business. We rely on salmon for the bulk of our income, though we also participate in halibut, sea cucumber, and cod fisheries. Our ability to stay in Kodiak depends on the health of the Kodiak salmon fishery. I respectfully request the Board reject Proposal 64.

This proposal seeks to regulate Kodiak's fisheries for the benefit of another area in ways that show little understanding of how Kodiak's mixed-stock fisheries work and are currently regulated. While limiting Kodiak's commercial fishery might bring a few more sockeye home to Cook Inlet's rivers, it would force Kodiak fishermen to sacrifice the potential harvest of our other stocks and cause over-escapement of other species up the river.

It also seems to assume that Kodiak currently bears no burden for conservation of Cook Inlet stocks. However, the North Shelikof Sockeye Management Plan has already been successfully established and limits the harvest of Cook Inlet bound Sockeye.

The Kodiak Salmon Management plan is good as it is and I see no need for any changes to it. Thank you for the opportunity to comment on the proposals before the meeting. As always, I look forward to visitors getting to enjoy our great down and vibrant fishing community.

I humbly request the Board reject Proposal 64.

Sincerely,

Tyler-Rose Hoffman
F/V Relentless

Corina Watt Kodiak Setnet Commercial Salmon Fisherman
Trap Pt/ Moser Bay Fisheries, Alitak District with sites in Olga, Moser & Alitak Bays
12/25/2019 09:10 PM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

I support proposal 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 for the following reasons: 1) It will increase the quality and viability of many local Kodiak sockeye salmon systems. 2) It will support a return to higher escapements for local sockeye systems including early and late Upper Station runs and Dog Salmon in the Alitak District of Kodiak. 3) It will support long term sustainability Kodiak sockeye salmon systems.

Ed Fisher, Kodiak Setnet Commercial Salmon Fisherman
Trap Pt/ Moser Bay Fisheries
12/25/2019 10:36 PM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

I support proposal 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 for the following reasons: 1) It will increase the quality and viability of many local Kodiak sockeye salmon systems. 2) It will support a return to higher escapements for local sockeye systems including early and late Upper Station runs and Dog Salmon in the Alitak District of Kodiak. 3) It will support long term sustainability Kodiak sockeye salmon systems.

Jason Watt Kodiak Setnet Commercial Fisherman
Trap Pt/ Moser Bay Fisheries: Alitak District with sites in Olga, Moser & Alitak Bays
12/25/2019 09:11 PM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

I support proposal 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 for the following reasons: 1) It will increase the quality and viability of many local Kodiak sockeye salmon systems. 2) It will support a return to higher escapements for local sockeye systems including early and late Upper Station runs and Dog Salmon in the Alitak District of Kodiak. 3) It will support long term sustainability Kodiak sockeye salmon systems.

Judy Fisher, Kodiak Setnet Commercial Salmon Fisher
Trap Pt/ Moser Bay Fisheries
12/25/2019 10:38 PM AKST

RE: PROPOSAL 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 based on those zones

I support proposal 64 Create “seaward” and “shoreward” zones in the Kodiak Management Area and amend management plans to restrict the commercial seine fishery June 28–July 25 for the following reasons: 1) It will increase the quality and viability of many local Kodiak sockeye salmon systems. 2) It will support a return to higher escapements for local sockeye systems including early and late Upper Station runs and Dog Salmon in the Alitak District of Kodiak. 3) It will support long term sustainability Kodiak sockeye salmon systems.

Aaren Ellsworth

12/28/2019 12:54 AM AKST

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

I oppose this proposal. First of all, the Alinchak and Katmai Bay Sections were not sampled during the 2014-2016 genetic study, so it seems unfounded to include those sections in this proposal. Second, Cook Inlet-bound sockeye are harvested incidentally all along the coast of Kodiak Island and the Mainland District. As was experienced with the North Shelikof plan, closing any one area to conserve Cook Inlet bound sockeye does not inhibit those fish from being caught elsewhere, and the closed areas would likely intensify fishing effort in the remaining open areas. Consequently, when Cook Inlet fish become available, more will be caught in the areas that remain open/ In short, given the magnitude of inner-annual variability and random migration patterns of Cook Inlet sockeye in the Kodiak Management Area, the entire area would have to be closed to have an impact on Cook Inlet's sockeye availability.

Aaron Nevin

12/27/2019 09:20 PM AKST

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

The Cape Igvak section is already managed in an overly conservative way. My name is Aaron Nevin. Being born in Kodiak to a commercial fisherman father I grew up fishing salmon on his seiner. I have continued on in my currently twenty year long career to buy a permit and run his boat after retirement. The seining season usually accounts for the majority of my annual income and is incredibly important to my family.

Adam Barker
Kashvik Fisheries LLC
12/27/2019 12:47 AM AKST

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

Adam Barker 41584 Manson Dr Homer, AK 99603 December 26th 2019 Chairman Reed Morisky Alaska Board of Fisheries-Board support section PO Box 115526 Juneau, AK 99811-5526 RE: prop # 65 Dear Chairman Moriskey and Board of Fish Members: My name is Adam Barker and I have been fishing in Kodiak since 1988, I'm a third generation fisherman. I bought into Kodiak Salmon seine in 1999 as a owner operator and now I take my two children out fishing, I also fish Tanner crab and will be doing that fishery in January. I respectfully request the board reject prop # 65. I oppose the Prop # 65 as trying to bolster an ailing Cook Inlet Gillnet fishery, by over-escaping the local Katmai, Alinchak and Cape Igvak areas. It doesn't make any sense to declare a stop fishing in these historic areas that has been well managed and contain numerous wild runs and multi species of salmonoids. Declaring a preferential fishery while ignoring current scientific facts is not a sustainable way to manage wild salmon stocks. Please reject Prop # 65 as unsound and not conducive to furthering commercial fishing. I thank you for the opportunity to comment. I hope the board continues to apply consistency in its application of the guiding policies such as the mixed stock fisheries policy and the sustainable fisheries policy. Sincerely, Adam Barker

Adelia Myrick

12/26/2019 10:22 AM AKST

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

Dear Board of Fish members: I am writing in opposition to proposal 65 for many reasons. As a 2nd generation setnetter, I have grave concerns about a blanked closure of these mainland areas. While at first glance it seems that it wouldn't affect me since it refers to sections where setnetters are not allowed to fish, it would actually drastically affect me because it would increase fishing pressure in our already crowded central section of the NW Kodiak District and would cause economic difficulties. My opposition isn't just personal, though. I am really concerned that a blanket closure like this is arbitrary and completely unjustified, not based on science. These fisheries are already managed based on Cape Igvak management and local stocks, and are managed, like ALL non-terminal Alaska salmon fisheries, with the stated recognition that there may be non-local stocks appearing from time to time. This is the common property principle. If you start amending these management plans, you are setting a dangerous precedent about mixed stock fisheries. I'm aware that Cook Inlet fishermen are eager to protect their fisheries and obtain more fish, but please, as a board, remember that whatever pressures and arguments are given need to be based in verifiable science and data and not an overwrought reading of a study that wasn't even designed to be used in this manner. Don't discount the work of previous generations of boards and fishermen that have worked so hard to craft management plans for this incredibly complex fishery. Thank you for your consideration, Adelia Myrick Uganik Bay setnetter

December 24, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 65

Dear Chairman Morisky and Board of Fisheries Members,

I am Alex Roth, Kodiak and Lower Cook Inlet salmon purse seine permit holder. Thank you for the opportunity to comment on proposals for the Kodiak finfish meeting. My wife and I reside in Homer, but fish in Kodiak. I own and operate the F/V Wandering Star. We rely solely on salmon seining for our livelihood and annual income to support our business, our family and contribute to our Alaskan economy through business and personal expenditures.

This proposal appears to be in response to an anomaly that occurred in fish migration patterns during 2016, and the proposer wants to bring up the genetic study as justification as need for change. Kodiak's North Shelikof Management Plan was created so that Kodiak fishermen would share the "conservation burden" with Cook Inlet by limiting fishing in that area so the goal of UCIDA's proposal is already addressed in current management. The genetic sockeye identification study undertaken in the Kodiak Management Area from 2014-16 really does not provide "new" information relative to the presence of Cook Inlet sockeye in the KMA, and is completely taken out of context because it only looked at sockeye rather than the full suite of salmon species that we fish for in Kodiak. This proposal would restrain fishing allowed during times of the Cape Igvak Management, which would make it difficult to reach Kodiak's traditional and historical 15% allocation which the Chignik proposals claim belong to Chignik, and Cook Inlet proposals, on the contrary, claim as their own. It would also prevent the ability to fish some areas as directed chum and early pink fisheries for Kodiak fishermen resulting in lost revenue and opportunity for our region.

Instead of an attempt to restructure the fisheries in a neighboring region, the Board's time would be better spent investigating the number of years the Kenai and Kasilof rivers have exceeded their escapement, and yet Cook Inlet drift-gillnetters and set-gillnetters still have minimal fishing time when in other regions there would be emergency openings to maintain the health of fish stocks and the rivers. For example, 2019 was a banner year, and yet commercial fishermen were forced to sit on their hands while the Kenai and Kasilof rivers were over-escaped by the hundreds of thousands.

I strongly encourage the Board to reject this proposal.

Alex and Jaime Roth
F/V Wandering Star
Homer, AK

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

Bo Calhoun 57177 Zulu Ct. Homer, AK 99603 12/26/19 RE: Opposition to Proposal #65 Dear Chairman Morisky and Board of Fish members: I'm a third generation Kodiak salmon seiner. I was born in Homer, raised in Port Lions and Homer, and continue to live in Homer. My wife and I hope to raise our two sons on our family seine boat in a healthy Kodiak salmon fishery. I respectfully request you reject Proposal #65. The wholesale closure of a traditionally fished area for almost a month based on one anomalous and incomplete genetic study is unjustified. This proposal would unnecessarily inhibit management and catch of local pink and chum salmon stocks. Please reject proposal #65. Thank you for taking the time to read public comments. Sincerely, Bo Calhoun

Brad and Kay Underwood

12/24/2019 10:07 AM AKST

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

Vote no on Proposal 65 The foundation of this proposal rests on a 3 year-study to determine the genetic composition of the Kodiak salmon harvest. This could provide the department with additional insight as how to best manage commercial fishing periods to achieve optimal salmon escapement targets. The problem with this study lies with its duration. Salmon migration compositions can vary significantly on a year-by-year basis. For a study of this nature to be statistically significant, it would have to take place over a much longer timeline. The degree of fluctuation possible in this 3-year analysis is probably high. The short duration of this study renders it unusable for implementing management changes. It is common knowledge that Kodiak is a mixed stock fishery. To have any relevance as a salmon management tool, this study would need to take in a much longer time frame of 20 years or more. To make allocative changes relying on data from such a short period of time is not scientifically sound. It would be irresponsible to base decisions on incomplete data. Kodiak has a long-established traditional salmon fishery and nothing in this proposal meets the allocation criteria as determined by the Board of Fish. The only sensible decision to be made at this time is to vote no on proposal 65. Brad and Kay Underwood

Brad Marden
PO Box 2856
Homer, AK 99603

December 23, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: **opposition to Proposal 65**

Dear Chairman Morisky and Board of Fish members:

I first participated in the Kodiak seine fishery for salmon in 2004. Since then, I've worked as a deckhand in various salmon, halibut, and herring fisheries throughout the state, before buying my own boat in 2012, followed by a Kodiak seine permit in 2013. Since then I have exclusively fished in Kodiak waters. I respectfully request the Board **reject Proposal 65**.

This proposal is a misguided attempt to conserve Cook Inlet-bound sockeye, but the major affects would all be negative: consolidation and crowding of the Kodiak fleet, over-escapement of local pink and chum stocks, and foregone revenue. Furthermore, the positive, intended effects would be negligible, for there is very little evidence that CI-bound sockeye frequent the southern mainland shoreline in any numbers. The anomalous stormy weather in July 2016 is one notable exception to this. The first three weeks of July are an important time for Kodiak fishermen to be able to spread out over the KMA and target local mixed stocks. Closing Katmai, Alinchak, and Igvak would be costly to all Kodiak fishermen, with negligible benefit to fishermen or fish stocks of concern in Cook Inlet or elsewhere.

The Board no doubt grows weary of endless testimony claiming that the fish of concern are "our fish being stolen by those guys over there". It seems that in my 15 years of commercial fishing in Alaskan waters, Kodiak salmon fishermen are often on the defensive. Rather than retaliate with countering proposals of our own, I ask that we maintain status quo and keep historical allocations and fishing opportunity. For this reason, I ask that you **reject Proposal 65**. Thank you for your service and I hope the Board continues to apply consistency in upholding Mixed Stock Fisheries Policy, and the Sustainable Fisheries Policy.

Sincerely,

Brad Marden

Brian Mcwethy
KSA
12/23/2019 09:32 AM AKST

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

My name is Brian Mcwethy. I was born and raised in kodiak. I live in kodiak with my family and we all depend on my income. I fished with my father on his seiner growing up and now I own and operate a seiner. Salmon seining and tanner crab fishing in kodiak are currently our only sources of income. I plan to try and continue to fish the kodiak waters and possible my children will have the opportunity to. I hope the current and historical areas we fish aren't taken from us and the future generations of kodiak. This proposal would seriously decrease the ability of kodiak fishermen to harvest local Kodiak salmon. My ability to provide for my family would potentially be taken away from me. I strongly oppose this proposal.

Charles and Theresa Peterson
1850 Three Sisters Way
Kodiak, AK 99615

December 26, 2019

Chairman Reed Moriskey
Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE**: Oppose Proposal 65**

Dear Chairman Morisky and Board of Fish members:

We moved to Kodiak in the 1980's to pursue the opportunity for a livelihood in commercial fishing. We found what we were looking for, a chance to make a living off the sea and stayed, raising three children and developing deep relationships in our island home. Kodiak is a community built on fish and the size of the fleet, the processing infrastructure, the support services and the overall health of our coastal community is dependent on sustainable fisheries. Salmon fishing is the mainstay of our commercial fishing business and without it we would not have the financial means to stay in Kodiak, maintain a vessel and prosecute other fisheries. We own a 42', shallow draft seine vessel that primarily operates in the Alitak district. Our son now runs the boat and Charles and I run a setnet site in Alitak Bay. We choose to diversify our salmon fishing with participation in both the seine and setnet fishery so our son can run the boat with his crew and the rest of the family can prosecute the fishery from a shore-based operation.

We are opposed to proposal 65. The proposal seeks to implement a significant change in the Cape Igvak and Mainland district management plans based on limited genetic data. The proposal lacks comprehensive science-based information to base sound decisions for fisheries management The genetic study referenced in the proposal was not intended to influence major management decisions. The genetic study covers an 18-month period and does not factor in the ocean changes experienced in the Gulf of Alaska from 2014-2016. As structured, the proposal would restrict fishing time in the Cape Igvak Management for a period which would make it difficult to harvest Kodiak's 15% allocation of the Chignik run.

Sincerely,

Charles and Theresa Peterson

December 22, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 65

Dear Chairman Morisky and Board of Fisheries Members,

My name is Chris Johnson and I am a second-generation fisherman in Kodiak, Alaska. I grew up fishing on my dad's boat and got my first crew job working for someone else two weeks after I graduated high school. I haven't missed a salmon season since. I bought into the fishing industry in 2011 with the purchase of a 25-foot jig boat that I worked for two years in the winter and spring months while I still crewed for salmon in the summer. Access to the jig fisheries focusing on cod and rockfish was the only way that I could afford to move into the salmon fleet with a 38-footer in 2013. After the recent cod collapse, I now primarily rely on salmon seining and live here year-round with my wife.

This proposal appears to be in response to an anomaly that occurred in "lightning strike" fish migration patterns during 2016, and the proposer wants to bring up the genetic study as justification as need for change. Kodiak's North Shelikof Management Plan was created so that Kodiak fishermen would share the "conservation burden" with Cook Inlet by limiting fishing in that area so the goal of UCIDA's proposal is already addressed in current management. Furthermore, the genetic sockeye identification study undertaken in the Kodiak Management Area from 2014-16 really does not provide "new" information relative to the presence of Cook Inlet sockeye in the KMA, was never intended to inform management decisions, and is completely taken out of context because it only looked at sockeye rather than the full suite of salmon species that we fish for in Kodiak. This proposal would restrain fishing allowed during times of the Cape Igvak Management, which would make it difficult to reach Kodiak's traditional and historical 15% allocation. It would also the prevent ability to fish some areas as directed chum and early pink fisheries for Kodiak fishermen resulting in lost revenue and opportunity for our region.

Taking away any fishing opportunity from Kodiak fishermen, particularly from the small boat fleet, would have a direct negative impact on new entrants trying to gain a foothold in this industry, fishing families trying to get by, and fishing support businesses in our region. I'm proud to call Kodiak home and am working to protect our fishing way of life.

Sincerely,
Chris Johnson
F/V North Star

December 22, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 65

Dear Chairman Morisky and Board of Fisheries Members,

My name is Danielle Ringer and I appreciate the opportunity to comment on proposals before the Board in writing and in person for the Kodiak finfish meeting. I live in Kodiak with my husband and we own and operate the 38-foot F/V North Star. We chiefly rely on salmon seining and cod and rockfish jigging to maintain our fishing way of life and ability to live on Kodiak Island. I grew up in Homer learning to harvest and process fish from my parents in Kachemak Bay and dipnetting on the Kenai River. I hold a Master's degree from the University of Alaska Fairbanks in Political Ecology of Fisheries and was one of the researchers on the *Graying of the Fleet in Alaska's Fisheries: Defining the Problem and Assessing Alternatives* study in the Kodiak region.

This proposal appears to be in response to an anomaly that occurred in "lightning strike" fish migration patterns during 2016, and the proposer wants to bring up the genetic study as justification as need for change. Kodiak's North Shelikof Management Plan was created so that Kodiak fishermen would share the "conservation burden" with Cook Inlet by limiting fishing in that area so the goal of UCIDA's proposal is already addressed in current management. Furthermore, the genetic sockeye identification study undertaken in the Kodiak Management Area from 2014-16 really does not provide "new" information relative to the presence of Cook Inlet sockeye in the KMA, was never intended to inform management decisions, and is completely taken out of context because it only looked at sockeye rather than the full suite of salmon species that we fish for in Kodiak. This proposal would restrain fishing allowed during times of the Cape Igvak Management, which would make it difficult to reach Kodiak's traditional and historical 15% allocation. It would also the prevent ability to fish some areas as directed chum and early pink fisheries for Kodiak fishermen resulting in lost revenue and opportunity for our region.

I see no biological, scientific, historical, economic, nor sociocultural reasons that could justify the Board making any changes to the salmon management plans in the Kodiak Management Area, which would create ripple effects negatively impacting Kodiak fishermen, processing workers, and community businesses. Thank you for your consideration of my comments and I look forward Board of Fisheries members spending time in our fishing community during the Kodiak meeting.

I humbly request the Board to reject this proposal.

Respectfully,
Danielle Ringer, M.A., F/V North Star

Dave Kubiak
F/V Lara Lee
12/21/2019 02:48 PM AKST

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

This is another Draconian solution for a non-existent problem. Nearly all fisheries in Alaska have incidental intercept catches of stocks bound for other areas. Salmon are free roaming and subject to the vagaries of wind and tide. To implement this proposal would interfere not only with the Cape Igvak Management Plan but would also prevent the harvest of pink and chum stocks along the mainland. This is an unnecessary and indefensible attack on Kodiak commercial salmon fishermen.

Donald Lawhead

12/26/2019 11:06 PM AKST

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

The mangement plans in place have worked for many years. Closing hundreds of miles of the Kodiak mangement area would cost fisherman millions of dollars. Commercial fishing is a hard living. You have to survive the bad seasons to get to the good ones.

Fred Stager

F/V Lady Lu

December 12, 2019

Alaska Board of Fisheries Board Support Section

P.O. Box 115526 Juneau, AK 99811-5526

RE: Opposition to Proposal 65

Dear Chairman Morisky and Board of Fish Members:

I am writing to express **opposition to proposal 65,** which will eliminate a long-standing traditional fishery.

The Alaska Board of Fisheries is obligated to use the best available science to make management decisions, and KSA understands that this standard means that the genetic stock assessment of sockeye salmon harvests in the Kodiak Management Area (KMA) can be used in its analysis. Nevertheless, if the Board is going to use this study and its scientific basis then the principle conclusions of the study cannot be ignored. Among the primary findings is that the harvest of nonlocal stocks is highly variable and unpredictable, and that harvest data cannot be extrapolated temporally or geographically. The proposal projects conclusions onto areas for which no data is available, on the results of a genetic study done in 2016 which was a year of bizarre and unheard of ocean conditions. Indeed, the results of 2015 stand in direct opposition to the results of the following year.

The unpredictability of salmon migrations and the need to preserve historical fishing communities while providing opportunities to harvest

local stocks is the very reason why the Board long-ago adopted the Mixed Stock Fisheries Policy. This proposal is asking the Board to entirely ignore the Mixed Stock Policy, discard the best available science, disregard and discount the preponderance of local stocks, and violate virtually every basic guiding principle and policy, including constitutional mandates on the utilization of fishery resources. This proposal would inflict certain and severe economic hardship on KMA fishermen, upend decades of responsible fishery management, and entirely erode confidence in the regulation of our fishery. It would do all of this simply and speculatively to provide more fish to a region that currently appears incapable of fully exploiting their local stocks.

Please reject proposal 65.

Thank You- Fred Stager

garrett kavanaugh

12/27/2019 05:21 PM AKST

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

Dear Chairman and Members of the Board, As a young fishermen who is working their way into the Kodiak Salmon fishery this proposal will cause Kodiak fishermen to lose a substantial amount of their catch. I have been investing into the Kodiak salmon fishery as much as possible, in 2019 I purchased a Kodiak salmon permit. I ran a seiner for the month of august. I plan on running the same boat for the entire 2020 salmon season in Kodiak. When I was younger I remember testifying against proposals similar to these. These proposals are re-allocations of Kodiak historical catch. Kodiak has always had intercept fisheries and we already have management plans in place that have been effective for the Kodiak salmon fishery. Please help ensure the future for young fishermen entering into the Kodiak Salmon fishery, and the people who have been investing and are established in the fishery. Thank you for considering these comments, Garrett Kavanaugh

Iver Holm

12/28/2019 12:30 AM AKST

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

Dear Chairman Morisky and Board of Fish members: I am 31 years old and a life long resident of Kodiak. I grew up set netting in Uganik on the west side of the island with my mother until i was 14. I then started seining with my father until I was able to buy my own Kodiak seine operational the age of 27. Please oppose proposal 65. thank you for your time sincerely
Iver Holm

James Calhoun

12/26/2019 04:07 PM AKST

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

I have been intimately involved in the Kodiak seine fishery since 1968 to present. Presently my son is fishing the Kodiak area and it is my desire to have my grandsons be able to participate in a healthy Kodiak fishery if they so desire. Throughout my career I have come to the conclusion that the ADF&G management for Kodiak has been stellar and has kept the stocks in Kodiak healthy overall with the current management plan. Local chum and pink stocks are harvested in this area. Please oppose proposal 65.Thank you.

Jamin Hall

12/27/2019 10:52 PM AKST

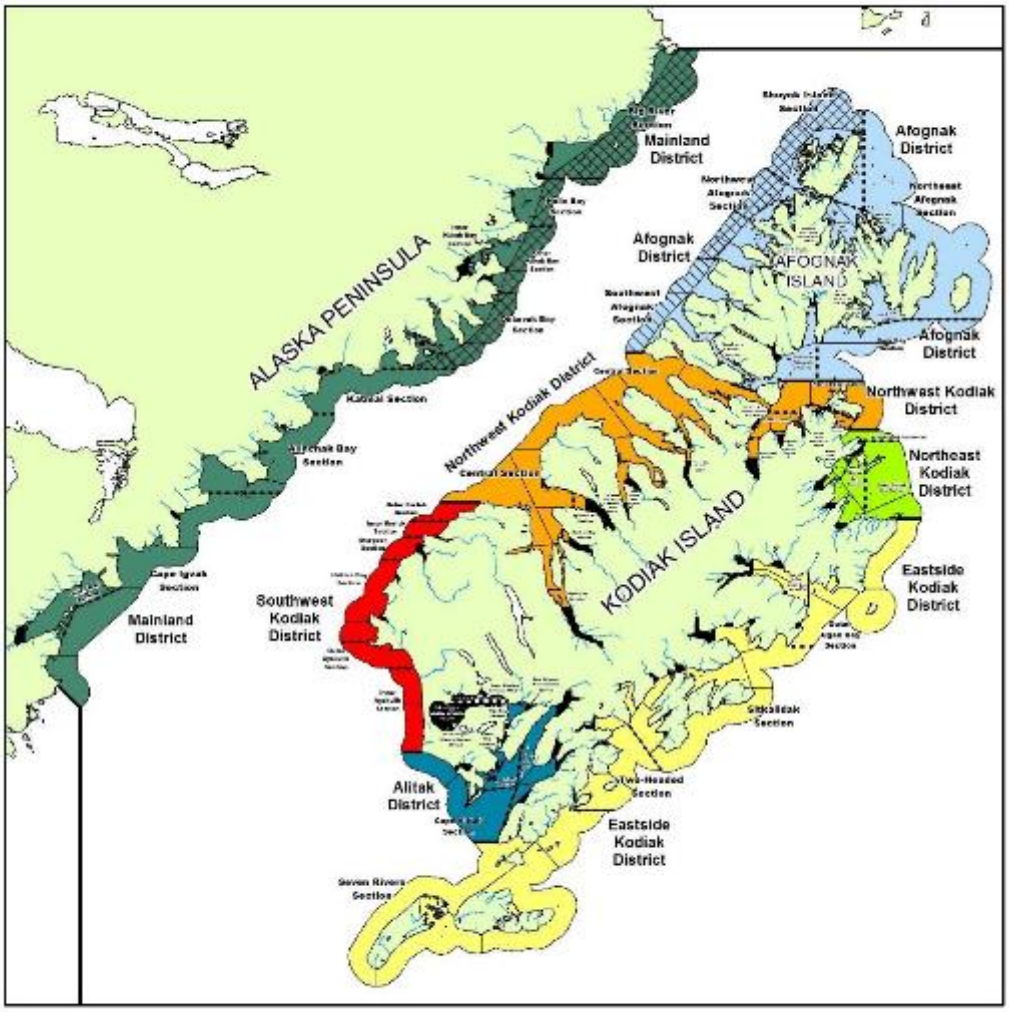
RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

My name is Jamin Hall, my wife and I have a set net site in Uganik Bay. I am writing in opposition to proposal 65. This proposal claims to not affect setnet fishermen, but in fact we would be more impacted because of the stationary nature of our fishery. All the seiners that would be displaced by the blanket closure of Kodiak's mainland fishing areas will migrate to the island and would put more intense pressure on areas where set net sites are located. When lineups at traditional sets get too long seiners go looking for new sets, and frequently cork setnet sites that have no ability to move. The Kodiak Management plan has been used and refined over a 30+ year period, taking into account all of the information that has been presented. Thank you for giving me the chance to voice my opposition.

Ken Christiansen
F/V Mary Ann
12/26/2019 03:56 PM AKST

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

The Author's reason for the proposal references the genetic study done in 2016 which was an anomaly. It was simply a snapshot of one point in time and does not reflect a pattern. I was one of the boats that happened to be fishing in the area during the time the fish were caught for that study, I have never, in more than 30 years of fishing in the Cape Igvak Section, seen fish go by like they did that year, and don't expect to ever see it again.



Economic Analysis Proposal 65

Kodiak Salmon Workgroup

Key Findings

- Overall, proposed changes from Proposal 65 would result in an economic loss in the Kodiak Borough of almost $730,000 a year.
- Restrictions would result 100% of the current sockeye catch being eliminated and an average loss per fisherman of more than $28,000 a year.

- Direct loss of foregone sockeye harvest per year ranges from $34,000 to $1.95 million over the time period examined (1998-2019). Mean foregone sockeye harvest is valued at $518,000 per year, using each year's prices.

$728 Thousand Dollars Yearly Direct Loss to Fishermen

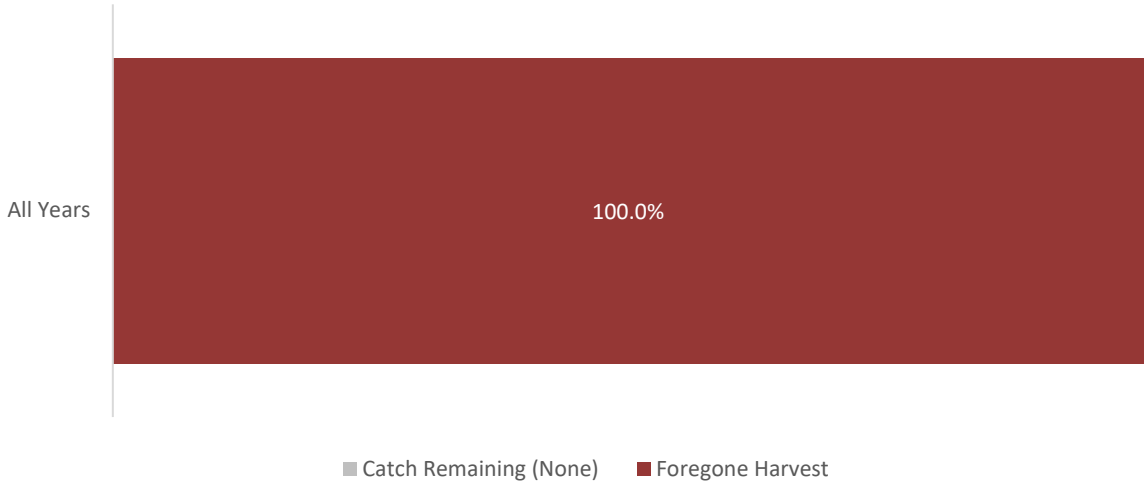
- Sockeye loss per permit holder affected ranges from $2,500 to $77,000 per year (mean $19,000), depending on the number of affected fisherman and the count of the foregone sockeye harvest.

$1.09 Million Dollars Annual Economic Loss in the Kodiak Borough

- Total foregone harvest among all species is estimated to be 892,000 pounds per year worth an average of $728,000 per year, using each year's prices. The average loss per affected permit holder is estimated to be $28,000 per year.

- Species specific foregone harvest is estimated to range between $13 (chinook) to $1.95 million (sockeye) per year.

Average Revenue Loss Per Year



Methodology and Data Sources

Background

The 2019-2020 Board of Fish, Kodiak Finfish Proposal 65 proposes to amend the Cape Igvak Management Plan and the Mainland District Management Plan by closing all commercial salmon fishing from June 28 through July 25.

Proposal 65 will impact three harvest areas in the Mainland District: Cape Igvak, Alinchak Bay, and Katmai sections.

Link to Proposal:
https://www.adfg.alaska.gov/static/regulations/regprocess/fisheriesboard/pdfs/2019-2020/proposals/65.pdf

Data Sources

Foregone harvest days count and pound data was provided by the State of Alaska, Department of Fish and Game daily harvest reports. Price data for 1998-2018 was provided from the State of Alaska, Department of Fish and Game *Commercial Operator's Annual Reports* (COAR). 2019 price data was not available through the COAR report at the time of this analysis. 2019 price data is estimated from the five-year average of the reported 2014-2018 price per pound per species (see methods below). Multipliers for indirect and induced economic impact were commissioned from the US Department of Commerce, Bureau of Economic Analysis specifically for the Alaska commercial fishing industry. Inflation rates are provided from the US Department of Labor, Consumer Price Index. Tax information is from the State of Alaska, Department of Revenue and the Kodiak Borough.

Data Methods

Economic impact is estimated using historical harvest data from 1998-2019. Proposal 65 applies to all gear types and all gear harvest totals used in estimating impact.

The total harvest counts in the affected areas were aggregated across days of closure and sections for each year. The value of foregone harvest is calculated as species-specific foregone harvest pounds multiplied by species-specific Kodiak area price per pound for each year. Foregone harvest counts and economic impact are calculated for the affected sections as a whole.

The number of permit holders affected by proposal 65 is calculated as the maximum number of unique permits during the closure period in harvest records.

Species specific prices per pound for each year between 1998-2018 were obtained from the Fish Game COAR for each individual year. The total net weight in the Kodiak area for each species for each season is divided by the respective net value.
Final 2019 COAR price per species data is not available. Species specific price for 2019 was estimated as a five-year average of available COAR data (2014-2018). Verification of 2019 data with the KSWG provided spreadsheets using Icicle, Ocean Beauty, and Pacific season prices for 2017-2019 compared to COAR for 2017, 2018. The spreadsheet values varied from published COAR by both higher and lower values up to 20%. The five-year average was much closer to 2017 and 2018 prices than the spreadsheet averages and weighted averages for respective years. The sockeye 2019 season price per pound estimate may be biased downwards given the processor spreadsheet; the COAR numbers were up to 20% lower than provided spreadsheet, and the five-year average is 16% lower than 2019 processor spreadsheet.

Indirect and induced economic loss was calculated from Regional Input-Output Modeling System (RIMS II) type I and type II multipliers. These take into account increase (in this case local loss) in

regional economic activity due to change in industry specific earnings. For this report, the fisheries industry specific multipliers were used. Selected industry multipliers are specific to Alaska.

All values are adjusted for inflation and shown in 2019 dollar values.

Results & Data Tables

Direct Losses

All years between 1998-2019 are affected by Proposal 65. 100% of the current catch would be restricted. Overall, these changes would result in an economic loss to the Borough of more than one million dollars a year.

$728 Thousand Dollars Yearly Direct Loss to Fishermen

$1.09 Million Dollars Annual Economic Loss in the Kodiak Borough

Direct revenue lost to the Kodiak Borough per year:

Direct loss per affected year: $728 Thousand
Loss from sockeye fishery: $518 Thousand

Fisheries employment impact: 6.4 jobs per year
All employment impact: 8.1 jobs per year
Indirect community loss: $151,091
Induced community loss: $212,881

Total Annual Borough Loss: $1,091,771

Proposal 65 would have impacts throughout the Kodiak Borough. The direct loss to fishermen would be $728,000 per year. Of the total loss to the fishery, the limitations on the sockeye fishery comprise the majority of the impact, accounting for $518,000 of the loss with $210,000 of the total loss distributed among other salmon species.

The direct impact of this proposal will result in a loss of 6.4 fisheries specific jobs and a total of 8.1 jobs overall in the Kodiak Borough per year. In addition to the direct loss impact of $728k, there is a further indirect loss of $151k as a result of lost business to business economic activity for the community from purchases such as fuel, gear, and supplies. There is an additional $212k of induced loss in the community resulting from the lost direct and indirect economic activity (total $879k) and reduced labor market. This impact results in a total loss to the community from direct, indirect, and induced losses of $1.09 million dollars per year.

Fisheries Loss

Proposal 65 results in fisheries restrictions in all years studied. There would be a 100% restriction during the affected years and would result in 100% revenue loss due to the entire catch being eliminated.

Chart 1: Average Revenue Loss Per Year

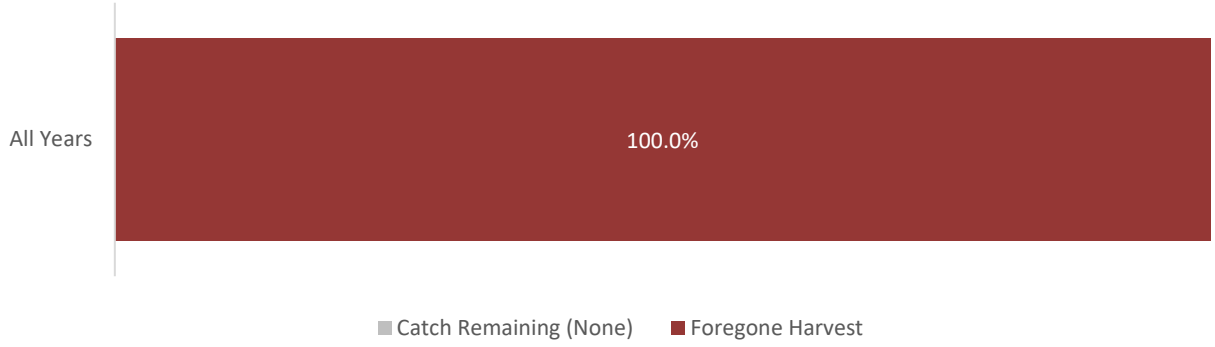
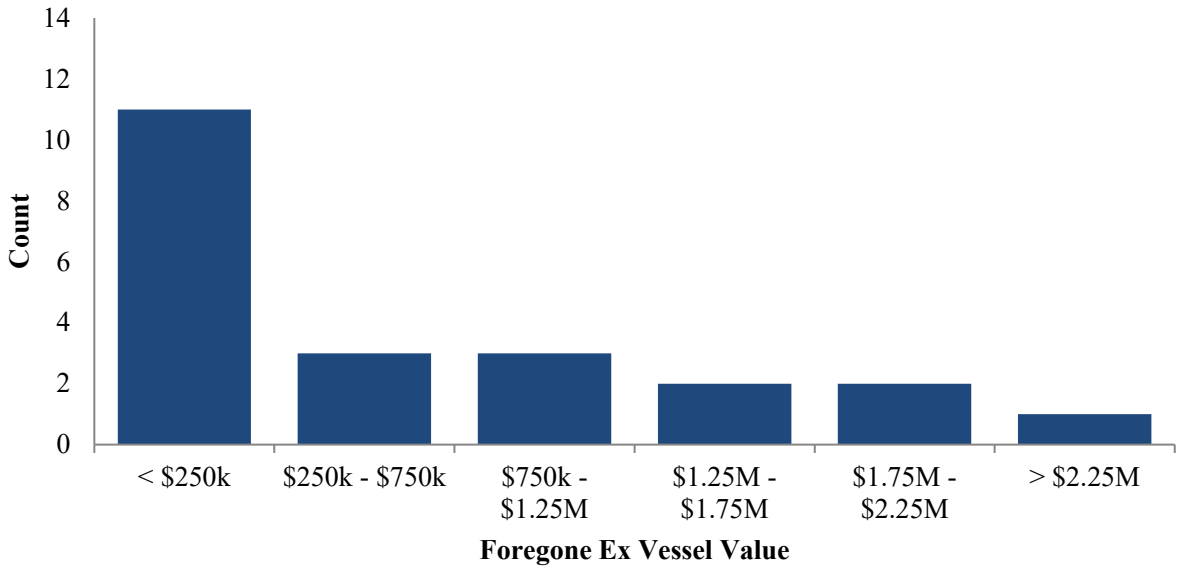


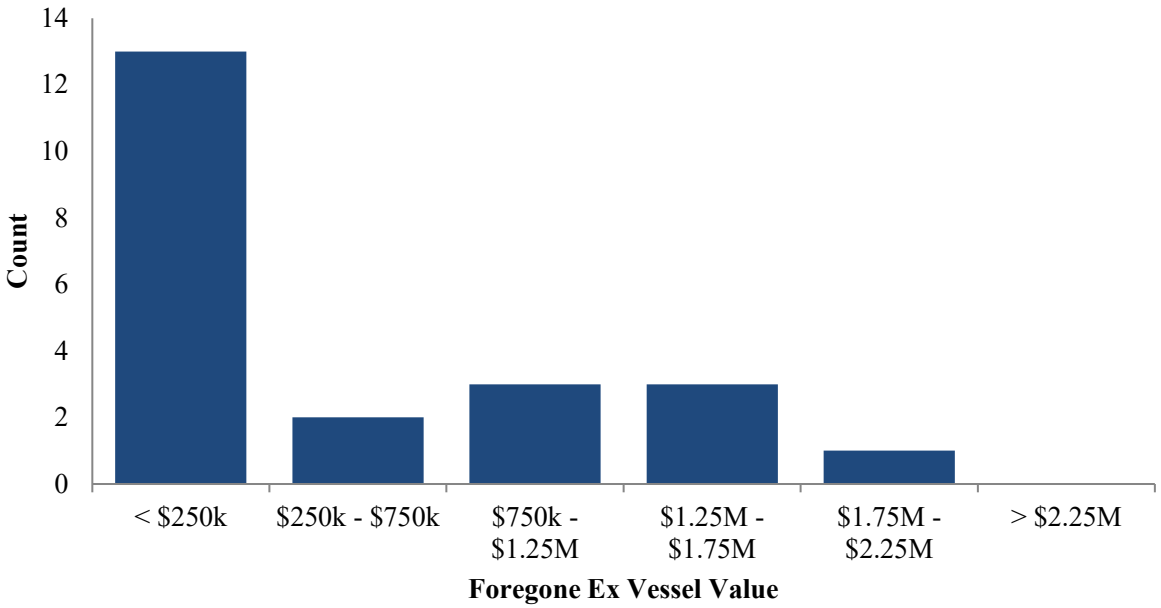
Chart 2: Total Fishery Loss 1998-2019



Over the last 22 years 1998-2019, there have been 11 years where the fisheries losses from the increased restrictions would result in a loss of more than $250k of foregone ex vessel value to the fishery. Fishing was severely restricted in 2018 due to historically low run returns.

The sockeye fishery would experience ex vessel losses of more than $250k for nine of the 22 affected years.

Chart 3: Total Sockeye Loss



The mean direct loss for all species per year is $727,799 with a median loss of $270,383. If these restrictions were in place the greatest impact would have been in 1999 with a loss of $2,397,827 and the least impact would have been in 2007 with a loss of $67,939.

Table 1: Direct Loss of Proposal 65 Implementation

Year	Direct Loss All Species	Direct Loss Sockeye
1998	$146,816	$104,543
1999	$2,397,827	$1,945,993
2000	$1,223,520	$814,025
2001	$1,233,843	$778,495
2002	$207,807	$158,458
2003	$138,032	$112,164
2004	$91,157	$39,187
2005	$165,479	$152,909
2006	$541,229	$161,965
2007	$67,939	$51,689
2008	$230,015	$92,087
2009	$2,073,829	$1,403,105
2010	$966,491	$468,127
2011	$75,711	$61,582
2012	$1,289,219	$1,064,664
2013	$2,125,020	$1,648,160

2014	$705,754	$653,833
2015	$120,382	$37,504
2016	$1,683,996	$1,463,957
2017	$310,751	$79,689
2018	$122,220	$33,855
2019	$94,534	$78,309
Mean	**$727,799**	**$518,377**
Median	**$270,383**	**$155,684**
Min	**$67,939**	**$33,855**
Max	**$2,397,827**	**$1,945,993**

Table 2: Direct Loss of Proposal 65 Implementation Per Fishermen

	Average Loss Per Fishermen – All Species	Average Loss Per Fishermen – Sockeye Only
Mean	**$28,507**	**$19,127**
Median	**$22,002**	**$11,614**
Min	**$7,549**	**$2,500**
Max	**$88,631**	**$77,050**

Based on the number of active permits per year, individual fishermen would experience a mean direct loss for all species per year of $28,507 with a median loss of $22,002. If these restrictions were in place the greatest impact would have been in 2016 with a loss of $88,631 per fishermen with the least impact in 2007 with an average loss of $7,549.

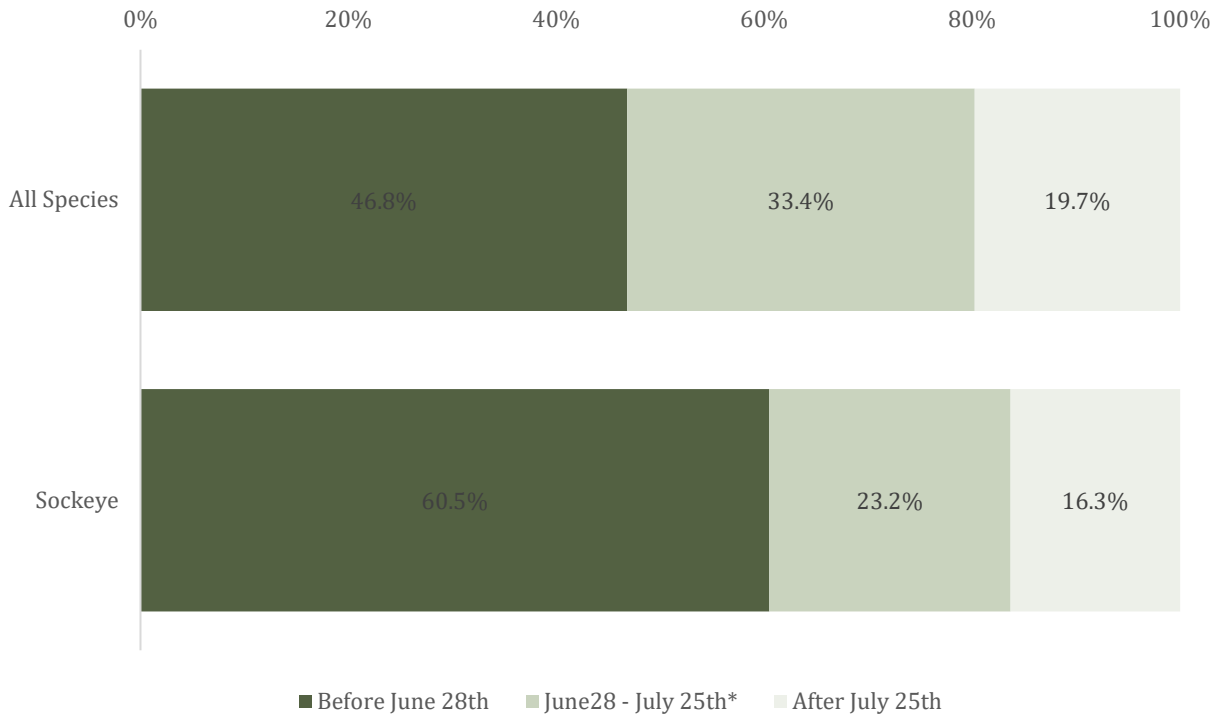
Table 3: Loss Per Affected Permit Holder

Year	Permits	Loss per Permit	Total Value Foregone Harvest	2019 Inflation Adjustment
1998	11	$13,347	$93,040	$146,816
1999	88	$27,248	$1,552,997	$2,397,827
2000	71	$17,233	$818,956	$1,223,520
2001	65	$18,982	$849,169	$1,233,843
2002	23	$9,035	$145,320	$207,807
2003	15	$9,202	$98,736	$138,032
2004	8	$11,395	$66,929	$91,157
2005	13	$12,729	$125,649	$165,479
2006	21	$25,773	$424,160	$541,229
2007	9	$7,549	$54,746	$67,939
2008	5	$46,003	$192,481	$230,015
2009	31	$66,898	$1,729,632	$2,073,829
2010	37	$26,121	$819,060	$966,491
2011	6	$12,618	$66,239	$75,711
2012	24	$53,717	$1,151,089	$1,289,219
2013	42	$50,596	$1,924,837	$2,125,020
2014	18	$39,209	$649,866	$705,754

2015	15	$8,025	$110,951	$120,382
2016	19	$88,631	$1,570,892	$1,683,996
2017	8	$38,844	$296,236	$310,751
2018	6	$20,370	$119,355	$122,220
2019	4	$23,634	$94,534	$94,534
Average		**$28,507**	**$588,858**	**$727,799**

On average, the majority of sockeye and almost half of total catch (by weight) in Cape Igvak for each season is caught before June 28th. For this reason, the impact of proposal 58 (total closure of Cape Igvak before July 8th) is much higher than the impact of proposal 65 (closure between 6/28 and 7/25). Of note, no fishing occurred in Cape Igvak during any year (1998-2019) between June 28th and July 8th.

Chart 4: Average Total Weight Caught During the Season in Cape Igvak by Time Period



Tables 4 and 5 show the percentage of foregone revenue that can be attributed to the closure of the Cape Igvak fishery in the proposal. The average foregone revenue due to the Cape Igvak closure over all years is almost 70% of the total Proposal 65 impact. For sockeye specific harvests, the average foregone revenue in Cape Igvak represents over 70% of the total impact of proposal 65.

Table 4: Total Percentage of Cape Igvak Loss

Year	Cape Igvak Loss	Total Propsal 65 Loss	Percentage of Proposal 65 Loss in Cape Igvak
1998	$132,121	$146,816	90.0%
1999	$2,111,372	$2,397,827	88.1%
2000	$736,588	$1,223,520	60.2%
2001	$1,023,480	$1,233,843	83.0%
2002	$61,545	$207,807	29.6%
2003	$101,686	$138,032	73.7%
2004	$0	$91,157	0.0%
2005	$0	$165,479	0.0%
2006	$360,153	$541,229	66.5%
2007	$0	$67,939	0.0%
2008	$0	$230,015	0.0%
2009	$1,732,055	$2,073,829	83.5%
2010	$609,942	$966,491	63.1%
2011	$0	$75,711	0.0%
2012	$1,075,452	$1,289,219	83.4%
2013	$1,659,823	$2,125,020	78.1%
2014	$0	$705,754	0.0%
2015	$88,829	$120,382	73.8%
2016	$1,495,056	$1,683,996	88.8%
2017	$0	$310,751	0.0%
2018	$0	$122,220	0.0%
2019	$0	$94,534	0.0%
Total	**$11,188,102**	**$16,011,573**	**69.9%**

Table 5: Total Percent of Cape Igvak Sockeye

Year	Cape Igvak Loss	Sockeye Propsal 65 Loss	Percentage of Proposal 65 Loss in Cape Igvak
1998	$91,646	$104,543	87.7%
1999	$1,706,015	$1,945,993	87.7%
2000	$507,833	$814,025	62.4%
2001	$678,098	$778,495	87.1%
2002	$41,398	$158,458	26.1%
2003	$89,455	$112,164	79.8%
2004	$0	$39,187	0.0%
2005	$0	$152,909	0.0%
2006	$101,706	$161,965	62.8%
2007	$0	$51,689	0.0%
2008	$0	$92,087	0.0%
2009	$1,183,727	$1,403,105	84.4%
2010	$251,614	$468,127	53.7%
2011	$0	$61,582	0.0%
2012	$895,887	$1,064,664	84.1%
2013	$1,257,994	$1,648,160	76.3%
2014	$0	$653,833	0.0%
2015	$25,292	$37,504	67.4%
2016	$1,303,468	$1,463,957	89.0%
2017	$0	$79,689	0.0%
2018	$0	$33,855	0.0%
2019	$0	$78,309	0.0%
Total	**$8,134,133**	**$11,404,301**	**71.3%**

Foregone Tax Revenue

The foregone harvest due to proposal 65 implementation would have tax implications for state, borough, and city budgets. The state implements two relevant taxes in the region: the fisheries business tax (which is shared with local governments) and the salmon enhancement tax (SET). Fisheries business tax rates vary by type of processing activity and the proportion of each is estimated from the State of Alaska's Annual Tax Report for FY18. The salmon enhancement tax rate is 2% in the Kodiak region. The Borough implements a resource severance tax of 1.075% and receives a share of the fisheries business tax from the state. The local city governments also receive a share of the fisheries business tax from the State of Alaska. Borough and city shares of the fisheries business tax estimated from the Borough's FY18 annual tax report.

The implementation of proposal 65 would result in average yearly tax losses of $26,201 to the State of Alaska, $11,542 to the Kodiak Borough, and $3,465 to Kodiak City.

State Taxes	
Fisheries Business Tax (50% Share)	$11,645
SET Tax	$14,556
Total	**$26,201**

Borough	
Resource Severance Tax	$7,824
Fisheries Business Tax (Share of 50%)	$3,719
Total	**$11,542**

Cities (Share of Fisheries Business Tax)	
Akhiok	$868
Kodiak	**$3,465**
Larsen Bay	$867
Old Harbor	$931
Ouzinkie	$900
Port Lions	$895
Total	**$7,926**

Loss by Species

Table 6: Sockeye Foregone Harvest

Year	Foregone Harvest - lbs	Sockeye Price	Foregone Harvest Value	2019 Inflation Adjustment
1998	55,800	$1.19	$66,251	$104,543
1999	1,166,503	$1.08	$1,260,358	$1,945,993
2000	609,230	$0.89	$544,863	$814,025
2001	763,415	$0.70	$535,785	$778,495
2002	180,293	$0.61	$110,810	$158,458
2003	133,000	$0.60	$80,232	$112,164
2004	44,024	$0.65	$28,772	$39,187
2005	144,708	$0.80	$116,104	$152,909
2006	151,257	$0.84	$126,932	$161,965
2007	41,707	$1.00	$41,651	$51,689
2008	64,537	$1.19	$77,060	$92,087
2009	1,040,967	$1.12	$1,170,230	$1,403,105
2010	279,880	$1.42	$396,718	$468,127
2011	35,304	$1.53	$53,877	$61,582
2012	645,522	$1.47	$950,593	$1,064,664
2013	820,177	$1.82	$1,492,898	$1,648,160
2014	329,061	$1.83	$602,056	$653,833
2015	37,243	$0.93	$34,565	$37,504
2016	1,070,735	$1.28	$1,365,632	$1,463,957
2017	50,218	$1.51	$75,966	$79,689
2018	18,346	$1.80	$33,061	$33,855
2019	53,286	$1.47	$78,309	$78,309
Total	**7,735,214**		**$9,242,724**	**$11,404,301**

Table 7: Chum Foregone Harvest

Year	Foregone Harvest - lbs	Chum Price	Foregone Harvest Value	2019 Inflation Adjustment
1998	20,271	$0.19	$3,856	$6,085
1999	910,698	$0.19	$169,023	$260,971
2000	794,870	$0.22	$172,605	$257,872
2001	740,149	$0.32	$236,219	$343,226
2002	85,122	$0.16	$13,758	$19,674
2003	55,954	$0.14	$7,791	$10,891

2004	140,533	$0.12	$17,258	$23,505
2005	18,862	$0.20	$3,810	$5,018
2006	386,085	$0.33	$129,049	$164,667
2007	7,421	$0.35	$2,612	$3,242
2008	160,362	$0.50	$80,562	$96,272
2009	516,758	$0.44	$226,457	$271,522
2010	530,747	$0.56	$297,336	$350,856
2011	10,089	$0.69	$6,962	$7,958
2012	223,269	$0.60	$134,478	$150,615
2013	461,053	$0.25	$117,089	$129,266
2014	22,366	$0.53	$11,836	$12,853
2015	42,520	$0.38	$16,217	$17,595
2016	160,443	$0.34	$54,092	$57,986
2017	341,331	$0.57	$195,797	$205,391
2018	102,689	$0.66	$67,990	$69,622
2019	7,628	$0.50	$3,789	$3,789
Total	**5,739,219**		**$1,968,585**	**$2,468,877**

Table 8: Pink Foregone Harvest

Year	Foregone Harvest - lbs	Pink Price	Foregone Harvest Value	2019 Inflation Adjustment
1998	135,874	$0.15	$20,461	$32,287
1999	584,663	$0.14	$82,411	$127,243
2000	202,081	$0.14	$29,054	$43,406
2001	409,715	$0.12	$48,629	$70,659
2002	199,244	$0.09	$17,132	$24,499
2003	100,905	$0.09	$8,860	$12,387
2004	185,986	$0.10	$17,839	$24,297
2005	27,314	$0.12	$3,280	$4,320
2006	850,847	$0.16	$139,219	$177,644
2007	28,513	$0.18	$5,143	$6,383
2008	87,350	$0.37	$31,963	$38,196
2009	1,118,713	$0.26	$287,838	$345,118
2010	153,039	$0.44	$66,575	$78,559
2011	7,125	$0.47	$3,316	$3,790
2012	107,543	$0.48	$51,294	$57,450
2013	550,599	$0.42	$232,986	$257,216
2014	70,834	$0.33	$23,475	$25,494
2015	224,346	$0.25	$55,126	$59,811

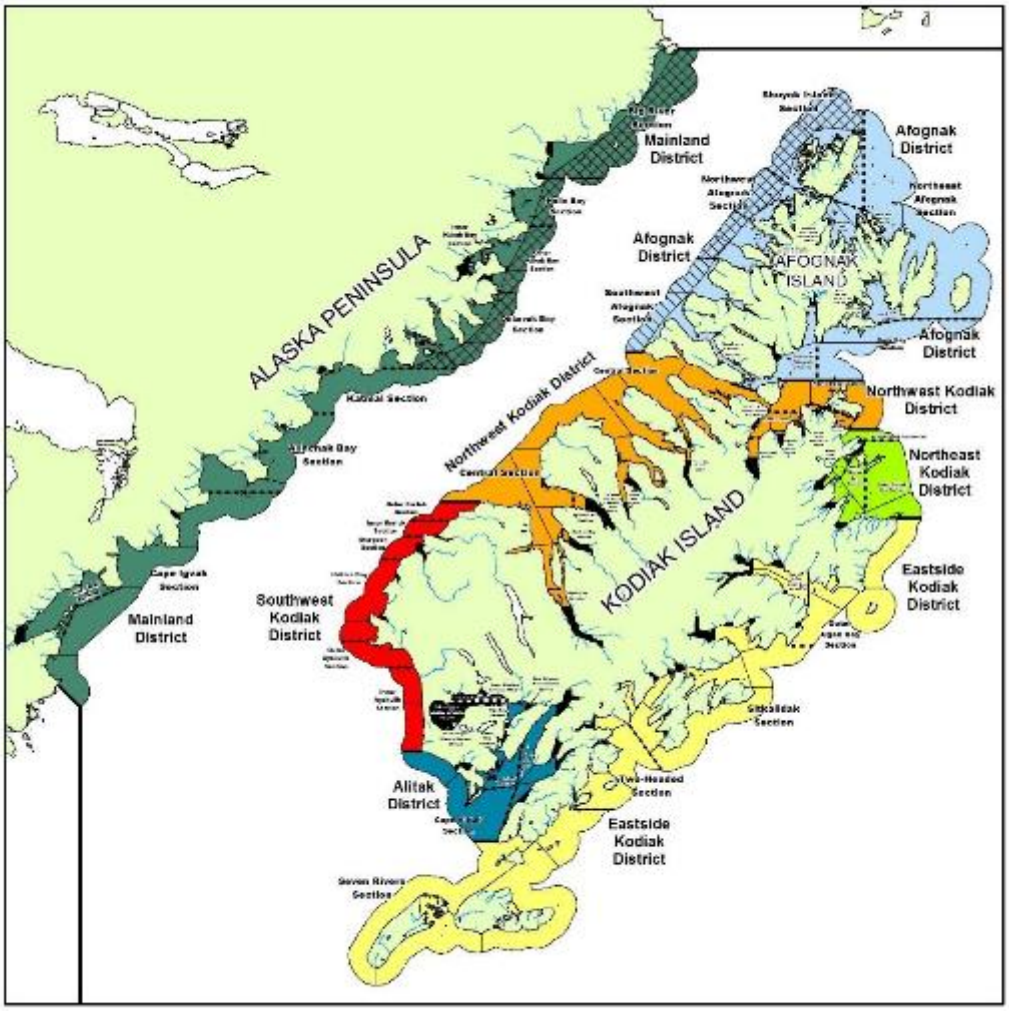
2016	180,458	$0.47	$85,178	$91,311
2017	53,278	$0.43	$22,817	$23,935
2018	28,395	$0.49	$13,905	$14,239
2019	25,534	$0.39	$10,046	$10,046
Total	**5,332,356**		**$1,256,550**	**$1,528,290**

Table 9: Coho Foregone Harvest

Year	Foregone Harvest - lbs	Coho Price	Foregone Harvest Value	2019 Inflation Adjustment
1998	5,009	$0.37	$1,851	$2,921
1999	70,545	$0.41	$28,624	$44,195
2000	138,459	$0.49	$67,506	$100,853
2001	32,609	$0.24	$7,834	$11,383
2002	13,470	$0.18	$2,393	$3,422
2003	8,160	$0.20	$1,631	$2,280
2004	9,843	$0.27	$2,667	$3,633
2005	2,039	$0.42	$857	$1,129
2006	22,374	$0.66	$14,807	$18,894
2007	6,379	$0.60	$3,812	$4,731
2008	1,696	$1.20	$2,034	$2,431
2009	56,982	$0.61	$34,699	$41,605
2010	64,269	$0.80	$51,217	$60,435
2011	2,288	$0.82	$1,870	$2,137
2012	7,634	$0.77	$5,885	$6,592
2013	77,138	$0.72	$55,214	$60,956
2014	17,624	$0.67	$11,864	$12,884
2015	13,084	$0.38	$5,031	$5,459
2016	75,101	$0.78	$58,815	$63,050
2017	663	$0.84	$554	$582
2018	3,540	$1.10	$3,903	$3,997
2019	1,693	$0.76	$1,279	$1,279
Total	**630,599**		**$364,349**	**$454,848**

Table 10: Chinook Foregone Harvest

Year	Foregone Harvest - lbs	Chinook Price	Foregone Harvest Value	2019 Inflation Adjustment
1998	876	$0.71	$620	$979
1999	18,479	$0.68	$12,581	$19,424
2000	7,440	$0.66	$4,929	$7,363
2001	28,771	$0.72	$20,703	$30,081
2002	3,330	$0.37	$1,226	$1,754
2003	625	$0.35	$222	$310
2004	763	$0.51	$393	$535
2005	2,099	$0.76	$1,597	$2,103
2006	15,099	$0.94	$14,153	$18,059
2007	1,713	$0.89	$1,527	$1,894
2008	859	$1.00	$861	$1,029
2009	15,211	$0.68	$10,408	$12,479
2010	11,192	$0.64	$7,214	$8,513
2011	238	$0.90	$213	$244
2012	14,551	$0.61	$8,839	$9,899
2013	46,327	$0.58	$26,651	$29,422
2014	661	$0.96	$636	$690
2015	18	$0.68	$12	$13
2016	7,921	$0.91	$7,176	$7,693
2017	1,438	$0.77	$1,101	$1,155
2018	641	$0.77	$495	$507
2019	1,359	$0.82	$1,111	$1,111
Total	**179,610**		**$122,665**	**$351,601**



Review of Genetic Studies of Sockeye Salmon Harvests in the Kodiak Management Area

Kodiak Salmon Working Group

Executive Summary

- Recent genetic analyses in Kodiak Management Area provide accurate and precise estimates of sockeye salmon stock proportions and harvest numbers in targeted Westside Kodiak fisheries, during monthly (June, July, August) time periods in 2014-2016. Very limited sampling occurred at Cape Igvak.

- The study was not designed to understand migratory patterns of sockeye salmon through KMA, nor to address finer temporal patterns of non-local stock distribution which might describe rapidly changing abundance of migrating stocks in specific areas. WASSIP results showed that proportions of one non-local reporting group varied by as much as eight fold in weekly samples of Shumagin Island and Dolgoi June fisheries harvests, 2007-2008.

- Harvests of Cook Inlet sockeye in KMA fisheries varied by an order of magnitude between study years and between monthly samples within a year. Incidental harvests in 2015 were particularly divergent, especially for July harvests, during an exceptionally large pink salmon run. The widely divergent harvest proportions of Cook Inlet fish in this three year study suggest no reliable patterns upon which to base specific management actions.

- Susitna bound fish overall represented the smallest component of Cook Inlet stocks incidentally harvested in KMA and accounted for less than 2.5% of total KMA sockeye harvest in 2014-2016 and less than 4.5% of

annual harvests in the sampled areas. Due to high estimated harvest rates of Susitna fish in Cook Inlet fisheries (average 38% 2006-2015) and large uncertainties in Susitna escapement estimates, it is unlikely that effects of any “savings” of these stocks in KMA fisheries could be measured with any confidence.

- In 2014-2016, estimated harvest of Susitna fish in Upper Cook Inlet fisheries was 3 fold to more than 40 fold greater than in KMA. Any conservation efforts for Susitna fish should be addressed in Cook Inlet fisheries.

- Data from Cape Igvak is limited to harvests in three temporal periods from two years. Incidental harvest of Cook Inlet fish varies by two orders of magnitude (50 fold) among those strata.

- Evidence suggests that management plans in KMA are working well, as all key sockeye stocks on the Westside are achieving their escapement goals and odd year pink salmon goals are consistently met.

Study Purpose and Design

The purpose of Shedd et al. (2016) was to use Genetic Stock Identification (GSI) methods to estimate temporal stock contribution to select Kodiak Management Area (KMA) sockeye fisheries during 2014-2016 by sampling major sockeye fisheries where significant harvest of salmon occurs (Foster and Dann, 2014, 2015). At its inception, the study intended to meet multiple information needs. Some local fishermen were

interested in a sampling program that could identify particular stocks in area fisheries, especially Alitak-bound fish harvested in Westside fisheries. Fisheries interests outside of Kodiak desired a better understanding of harvests of “non-local” sockeye salmon in Kodiak area fisheries; and area biologists who sought to understand production dynamics of area stocks wanted better stock-specific harvest information for improvement of brood tables, run-reconstructions, and escapement goals for local stocks. Funding constraints resulted in a limited geographic scope for the study.

The work provided accurate and precise estimates of stock-specific harvests for six Westside fishery areas within the KMA over approximately monthly time periods (June,July, August), during the years 2014-2016. Much more limited sampling occurred in Igvak fisheries. Within this scope, it is a robust study which uses state of the art analytic and statistical approaches to generate estimates for sampled areas and times. It has contributed to brood table improvement for area sockeye stocks, especially Karluk and Ayakulik (ADFG, pers. comm).

As the author notes, the study was not designed to understand migratory patterns of sockeye salmon through KMA (Shedd et al., 2016). The design also does not address finer temporal scale patterns of non-local stock distribution which might describe rapidly changing abundance of migrating stocks in specific areas, or address broader questions about sockeye migratory characteristics in and around Kodiak Island outside of sampled areas. Both are important to inform policy debate on allocating harvests from one management area to another.

Finally, there is no information provided on harvest rates to provide context for actual impacts of non-local stock harvest in Kodiak area fisheries. An understanding of stock-specific harvests with respect to run

sizes (i.e., harvest rates) for those non-local stocks is essential for discussing perceived conservation issues (Habicht et al., 2012).

Sampling

Samples for genetic analyses were gathered at fish processing facilities in Kodiak, Larsen Bay and Alitak. Through close communication with processors, samplers could be in place at facilities when deliveries occurred. Efforts were made to ensure samples only represented fishing in one of the management areas intended for sampling and were taken only from deliveries that could be attributed to the intended area. Deliveries from multiple study areas were not sampled. In Uganik/Kupreanof portion of the NW Kodiak district, where both set gillnet and purse seine vessels contributed to harvests, most samples were taken from set gillnet harvests because seine vessels often had mixed loads (ADFG, pers. com.). Brennan et al., (2017, this volume) point out that gillnets used there are selective for larger fish and sampling from mostly this gear group in Uganik/Kupreanof could bias samples towards Cook Inlet harvests because Cook Inlet sockeye are typically larger fish than Karluk Lake sockeye.

Samples from specific area harvests were collected a number of times, often weekly or more often, throughout the monthly sampling stratum when fish were delivered (Shedd at al., 2016 and ADF&G pers. comm.). Samples were taken on specific dates from fish available on that date. It is not completely clear how samples were randomized within a delivery, but generally, the target sample number (100-400) was taken from the delivery and placed in a separate tote for sampling. These samples represented a bulk sample of tissues from fish for that date. Typically, at least four bulk samples were acquired during monthly periods for each area. Each sample

represents the group of fish delivered on a one or two day period (see Shedd et al. 2016, Appendix B for details).

Post-season, samples for genetic analyses were selected from date-specific bulk samples in proportion to daily harvests for that month, and combined to generate a monthly stock contribution estimate. Previous reviewers of the study have found the general approach of stratified random sampling, sampling in proportion to the harvest and sample sizes to be defensible (Geiger and Quinn, 2017, this volume). To summarize the sampling approach:

- Sampling was adequate for generating monthly estimates of stock-specific sockeye harvest in targeted areas. Samples were collected periodically through the month, and care was taken to ensure that sampled deliveries were from intended fishery areas. Samples selected for analysis were taken from all bulk samples in proportion to the harvest for the month.

- Sampling was not designed to identify times and areas where non-local stocks are most prevalent in KMA or to provide comprehensive information on migration patterns. The study estimated stock proportions and harvests from targeted areas in select Westside fisheries and Igvak using monthly time periods.

- Spatial resolution was limited to major Westside KMA fisheries including Uganik/Kupreanof, Uyak, Karluk/Halibut Bay, Ayakulik/Sturgeon and Alitak, and Cape Igvak in the Mainland District. There are no comprehensive mixed stock analyses for fisheries in Afognak, Eastside District, Olga Bay, Special Harvest

Areas, nor for harvest after August 29, presumed to be mainly local stocks. Authors estimate that sampled areas represented 47-62% of Kodiak sockeye harvest in 2014-2016.

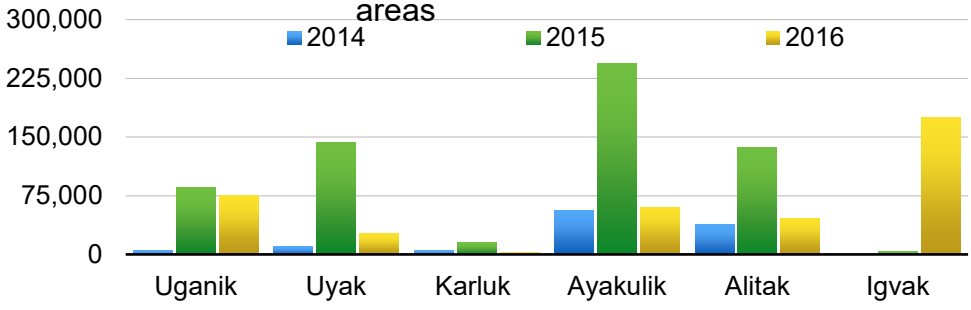
- Temporal resolution was limited to stock compositions for June, July, and August. The periods roughly coincide with fishery management approaches during each period, where early sockeye stocks are harvested in the early stratum (June), pink salmon and sockeye stocks in the middle stratum (July), and late sockeye and pink salmon in the late stratum (August). Harvest stock composition within the monthly periods was not examined.

Results: Variation within and between years

Cook Inlet Stocks

There are very large inter-annual differences among sampled areas in KMA for harvest of Cook Inlet genetic reporting group. Annual estimates of Cook Inlet harvest numbers for all sampled KMA fisheries varied by an

Figure 1. Annual harvests of Cook Inlet bound sockeye salmon within individual Kodiak Management sub-areas



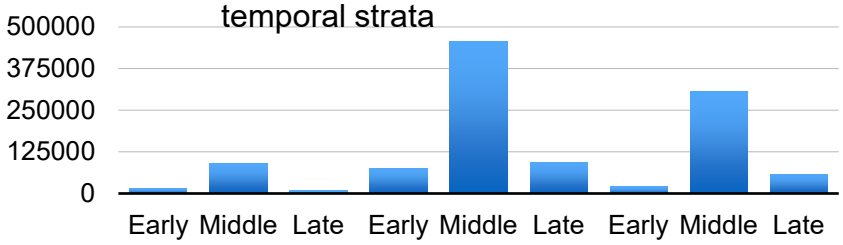
order of magnitude between years, especially evident for Uyak, Ayakulik/Sturgeon, and Alitak, where 2015 estimates far exceeded either adjacent year. Uganik/Kupreanof harvests of Cook Inlet fish in 2016 were

comparable to those in 2015 and Igvak had a single, large catch of Cook Inlet stocks in July 2016. Estimated harvests of Cook Inlet reporting group in 2014 were uniformly small for all sampled areas (Figure 1).

It is also clear that incidental harvest of Cook Inlet sockeye stocks in July (middle stratum) were dramatically larger than early or late strata in 2015 and 2016 (Figure 2). This is particularly pronounced for Alitak and Ayakulik/Halibut Bay harvests. For the Alitak District, harvests of Cook Inlet stocks in July (middle stratum) were an order of magnitude higher than early or late strata in all years. Harvests were more than three times larger in 2015 than middle strata in 2014 or 2016 (Figure 3). July (middle stratum) harvests of Cook Inlet stocks in Ayakulik/Halibut Bay were also highest in all years, and much higher in 2015 (Figure 3).

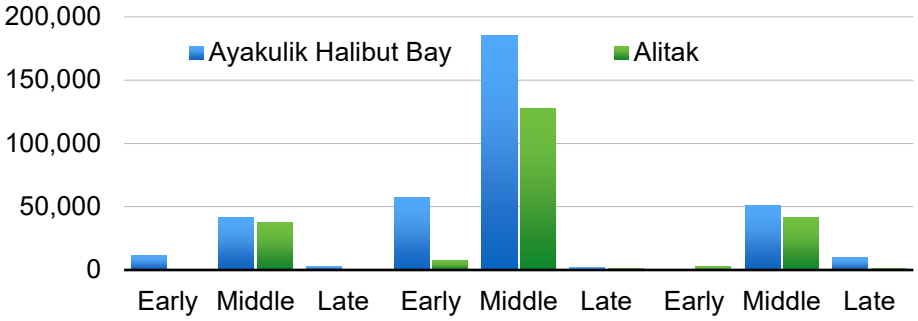
Higher incidental harvest of non-local sockeye in 2015 are likely associated with a very large pink salmon run. At 33 million, pink salmon harvest in 2015 was more than 3 fold larger than 2014 and roughly ten times greater than 2016 (Anderson et al. 2016). The large abundance of pink salmon in 2015 resulted in management actions to increase fishing time. Westside commercial fishing periods in 2015 were extended twice in July and many were open for the majority of August (Anderson et al., 2016). Larger incidental harvests of Cook Inlet sockeye in Westside

Figure 2. Harvests of Cook Inlet bound sockeye salmon in Kodiak Management Area among all sampled areas and years, by temporal strata



isheries during 2015 may partially be explained by pink salmon bundance, reflecting management actions in complex, multi-species fisheries.

Figure 3. Harvest of Cook Inlet bound sockeye salmon by temporal strata, over all years, in Ayakulik/Halibut Bay and Alitak sub-areas of KMA.



While Shedd et al. (2016) is the first genetic stock identification study to focus on KMA, it is modeled after the large WASSIP study which also revealed wide variation in stock specific harvests between and within sampling years, especially for those fisheries known to harvest a mixture of stocks on the South Alaska Peninsula (Dann et al., 2012). The East of WASSIP (EOW) reporting group in that study is a good example. It represents mixed stock analysis assignments made to stock groups beyond Chignik, the Eastern boundary of WASSIP. Specific stock composition of EOW reporting group is unknown, but it likely contains significant and variable proportions of Kodiak, Chignik and Cook Inlet stocks.

- For the Western and Perryville Districts within Chignik Management Area, samples from the same 10 day time interval in July (7/20-7/31) showed EOW reporting group harvest proportions more than twice as high in 2007 (38.8%) as 2008 (14.9%).

- For the Shumagin Islands June fishery, large differences were also observed for the EOW reporting group proportions among years and within weekly sampling periods. In 2006, among three sampled strata in June, EOW proportions ranged from 18.6% to 43.6%. In 2007, proportions for the same weekly strata ranged between 4.9% and 16.5%. For comparable strata sampled in 2008, the range was 9.4% to 10.6%. Over the three year period, harvest proportions for EOW reporting group in Shumagin June fisheries varied nearly nine fold within the month of June.

- For Dolgoi Area June fisheries, among weekly strata, proportions of EOW reporting group ranged from 17.1% to 39.5% in 2006, 35.8% to 56.2% in 2007, and 7.4% to 27.4% in 2008. EOW proportions varied by nearly 8 fold in Dolgoi within and among years in the WASSIP study (Dann et al., 2012).

Both WASSIP investigators and Shedd et al. (2016) express pointed caution about making inferences beyond their three year study periods. Like any GSI study, the data represent environmental and fishery conditions during those years and changes in relative proportions of reporting groups will be influenced by prosecution of fisheries and ocean conditions (physical and biological) which affect fish migrations. The wide

variation observed in WASSIP between weekly sampling intervals among years demonstrates how much stock specific harvests may change within a monthly period. The broad inter-annual variation in WASSIP and the recent KMA study should emphasize the inherent uncertainty in our understanding of stock vulnerability to commercial fisheries from year to year and within a fishing season.

Results: Measuring Impacts

Shedd et al., (2016) showed that over a three year study period, highly variable numbers of Cook Inlet sockeye salmon were harvested in KMA at some locations and times. However, these data alone provide little insight into impacts of these non-local harvests on Cook Inlet runs. Fishery stakeholders in the WASSIP study, from Area L to AYK, insisted that reporting of stock proportions be accompanied by harvest rates, so that stock-specific harvests could be assessed in relation to their respective run sizes (Habicht et al., 2012). The importance of this exercise is clearly demonstrated by WASSIP data for Outer Port Heiden (OPH) harvests during 2007-2008. Among six sampled time strata for OPH fisheries in 2007-2008, Bristol Bay stocks represented 65%-90% of the sample, while harvest rates on Bristol Bay fish for the same two years were less than 1% (Dann et al., 2012, Habicht et al., 2012). Significant numbers of sockeye bound for Bristol Bay were harvested in OPH, with negligible effect on the overall run.

Though no harvest rates were reported, Shedd et al. (2016) produced analyses to distinguish among four different genetic reporting groups within broader Cook Inlet harvests, including Susitna River, a currently designated stock of concern (Shedd et al., 2017). Overall, Susitna fish represented the

smallest component of incidental Cook Inlet harvests in KMA, representing 0.3% to 4.4% of KMA commercial sockeye harvests in sampled fisheries during 2014-2016 (Shedd et al., 2017). They represented only 0.1% to 2.4% of the total KMA sockeye harvest for study years 2014-2016.

Having dispensed with a biased sonar program (Fair et al., 2009), assessment of escapement for Susitna sockeye is now made by three weirs on Judd, Chelatna and Larson Lakes. Based on mark-recapture experiments in 2006-2008, Fair et al. (2009) estimated that combined Chelatna and Judd Lake escapements represent about 42% of Yenta drainage escapements and Larson Lake represents roughly 52% of mainstem Susitna escapement. Escapement goals for these lakes were established in 2017. Over the last decade, goals for Chelatna have always been met or exceeded, Judd was below goal in a single year, and Larson missed three goals by less than 20% (Munro, 2019). Escapements to these index lakes by themselves do not suggest a concern for conservation of Susitna fish. Other Lakes, such as Shell, once estimated to account for 10% of Susitna drainage sockeye production, have been severely impacted by pike predation and Beaver dams, and produce far fewer sockeye than in the past (Shields and Frothingham, 2018).

If management actions were taken to reduce harvest of Susitna bound sockeye in KMA, it is important to consider the fate of these “savings” and how we could evaluate effects of these actions. Any incidental harvest of Cook Inlet stocks avoided in KMA fisheries would be subject to a variety of harvest and natural mortalities before reaching spawning grounds, as they pass through fisheries in Lower and Upper Cook Inlet. Recent estimates of harvest rates on Susitna origin sockeye in Upper Cook Inlet fisheries range widely, but average 38%, 2006-2015

(Erickson, 2017, ADF&G report to Board of Fisheries). A large proportion of these fish would be harvested in Cook Inlet fisheries before reaching their natal streams and lakes.

Importantly, impacts of Susitna bound sockeye harvest in KMA on annual Susitna runs probably cannot be measured with confidence for two reasons. First, Shedd et al. (2017) used a genetic baseline that includes populations throughout the Susitna/Yentna drainage but does not distinguish fish which may be destined for Judd, Chelatna and Larson Lakes. The lake stocks can be justified as a separate JCL reporting group in Cook Inlet genetic studies (Barclay, 2018). As a result, the relationship between KMA harvest of Susitna reporting group and goals established to index Susitna escapement is unknown because KMA harvests of Susitna stocks cannot be attributed to any of these lakes.

Also, recent mark recapture studies suggest large uncertainties with estimating drainage wide escapements to Susitna drainage (Yanusz et al., 2007). Results from 2006-2008 studies revealed wide 95% confidence intervals (2006, 335,448 - 500,946; 2007, 292,867 - 362,597; 2008, 320,763 - 398,317) for escapements of sockeye to Yenta and Susitna Rivers combined (Erickson, ADFG report to Board of Fisheries). The highest estimated catch for Susitna fish in any KMA stratum, without accounting for additional harvest and predation in Cook Inlet, falls within those confidence intervals. It is unlikely that effects of reducing harvest of Susitna fish in KMA could be detected in Susitna run estimates.

In 2014-2016, estimated harvest of Susitna fish in Upper Cook Inlet fisheries was 3 fold to more than 40 fold greater than in KMA (Barclay, 2018, Shedd et al., 2016). Attempts to conserve Susitna fish must primarily

include Cook Inlet fisheries, where savings are more efficiently realized and can be measured.

Cape Igvak

The management plan for Cape Igvak has been in place since 1978. The Cape Igvak fishery is one of only two areas in the state (the other is Southeast District Mainland) in which harvest and escapement triggers from an adjacent management area (both Area L-Chignik) must be met before the fishery can open. For this study, no Igvak samples were taken in 2014 because low Chignik harvest numbers kept the area closed to commercial harvest. In 2015, only the July stratum (middle) was sampled as Igvak was again closed at first due to inadequate harvests in Chignik. Harvest of Chignik fish in Igvak was estimated as 2,059 fish. In both 2014 and 2015, the management plan had its intended effect of keeping Igvak closed or limited when Chignik harvests were low. In 2016, with a stronger Chignik run, an estimated 114,412 Chignik sockeye were harvested in the early (June) stratum. A little more than 10,006 Chignik fish were harvested in July. With only three temporal strata sampled over a three year period, there is no new information on harvest patterns of Chignik fish at Igvak that would support changes to the management plan. While it is clear that some Chignik fish are captured at Igvak (which is reason for the management plan), one data point an order of magnitude greater than the other two reveals dramatic swings in non-local stock abundance. There is no data in this study that supports the presumption in the management plan that 90% of sockeye salmon harvests in Igvak are Chignik bound fish.

Management Plans

The management of KMA fisheries is guided by a number of management plans including the Westside Management plan (5AAC 18.362) and the Alitak District Management plan (5AAC 18.361), most relevant to this genetics study. While each has very specific management direction for date ranges and particular areas, the central theme is prosecution of traditional fisheries to sustainably harvest early and late runs of sockeye salmon to Karluk, Ayakulik, Upper Station and Frazer Rivers, as well as harvest pink, chum and coho salmon to a variety of locations in July, August and September. The plans have an odd year emphasis for pink salmon management as these are typically larger than even year runs in KMA.

From a biological perspective, successful fisheries management in Alaska is measured through achievement of escapement goals. The Alaska Board of Fisheries pays careful attention to escapement goal performance as a yardstick for sustainable management. For Karluk early sockeye, goals have been achieved or exceeded every year since 2012, and for the late run, since 2010. For early and late sockeye runs to Ayakulik , goals have been achieved every year since 2010. For early Upper Station stock, goals were achieved in 2017 and 2018 and for late Upper Station, goals have been met every year since 2010. For Frazer Lake sockeye, goals have been met every year since 2010. Odd year pink salmon goals in the Kodiak Archipelago have been met or exceeded every year since 2011 (Munro, 2019). Recognizing that scientifically defensible escapement goals are foundational for maximizing yields in future years, it seems clear that

KMA fisheries management has been successful and that these management plans are working well.

Literature Cited

Anderson, T .J., J. Jackson, B. A. Fuerst, and A. E. Dorner. 2019. Kodiak Management Area commercial salmon fishery annual management report, 2018. Alaska Department of Fish and Game, Fishery Management Report No. 19-17, Anchorage.

Barclay, A. W. 2019. Genetic stock identification of Upper Cook Inlet sockeye salmon harvest, 2015-2018. Alaska Department of Fish and Game, Regional Information Report 5J19-02, Juneau.

Barclay, A. W., C. Habicht, W. Gist, and T. M. Willette. 2017. Genetic stock identification of Upper Cook Inlet coho salmon harvest, 2013-2015. Alaska Department of Fish and Game, Regional Information Report 5J17-03, Anchorage.

Brennan et al., 2017

Dann, T. H., C. Habicht, S. D. R. Olive, H. L. Liller, E. K. C. Fox, J. R. Jasper, A. R. Munro, M. J. Witteveen, T. T. Baker, K. G. Howard, E. C. Volk and W. D. Templin. 2012. Stock composition of sockeye salmon harvests in fisheries of the Western Alaska Salmon Stock Identification Program (WASSIP), 2006-2008. Alaska Department of Fish and Game, Special Publication No. 12-22, Anchorage.

Erickson, J. (2017) Review of Susitna River sockeye salmon stock status. Oral report to the Alaska Board of Fisheries.

Fair, L. F., T. M. Willette, and J. Erickson. 2009. Escapement goal review for Susitna River sockeye salmon, 2009. Alaska Department of Fish and Game, Fishery Manuscript Series No. 09-01, Anchorage.

Foster, M. B., and T. H. Dann. 2014. Genetic stock composition of sockeye salmon harvested in commercial salmon fisheries of Kodiak Management Area, 2014. Alaska Department of Fish and Game, Regional Operational Plan ROP.CF.4K.2014.24, Kodiak.

Foster, M. B., and T. H. Dann. 2015. Genetic stock composition of sockeye salmon harvested in commercial salmon fisheries of the Kodiak Management Area, 2015-2016. Alaska Department of Fish and Game, Regional Operational Plan No. ROP.CF.4K.2015.15, Kodiak.

Habicht, C., A. R. Munro, T. H. Dann, D. M. Eggers, W. D. Templin, M. J. Witteveen, T. T. Baker, K. G. Howard, J. R. Jasper, S. D. R. Olive, H. L. Liller, E. L. Chenoweth and E. C. Volk. 2012. Harvest and harvest rates of sockeye salmon stocks in fisheries of the

Western Alaska Salmon Stock Identification Program (WASSIP), 2006-2008. Alaska Department of Fish and Game, Special Publication No. 12-24, Anchorage.

Munro, A. R. 2019. Summary of Pacific salmon escapement goals in Alaska with a review of escapements from 2010 to 2018. Alaska Department of Fish and Game, Fishery Manuscript Series No. 19-05, Anchorage.

Shedd, K. R., M. B. Foster, T. H. Dann, H. A. Hoyt, M. L. Wattum, and C. Habicht. 2016. Genetic stock composition of the commercial harvest of sockeye salmon in Kodiak management area, 2014?2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-10, Anchorage.

Shedd, K. R., M. B. Foster, and C. Habicht. 2017. Addendum to FMS 16-10: Redefinition of reporting groups to separate Cook Inlet into four groups for the genetic stock composition of the commercial harvest of sockeye salmon in Kodiak Management Area, 2014?2016. Alaska Department of Fish and Game, Fishery Manuscript No. 17-07, Anchorage.

Shedd, K. R., T. H. Dann, H. A. Hoyt, M. B. Foster, and C. Habicht. 2016. Genetic baseline of North American sockeye salmon for mixed stock analyses of Kodiak Management Area commercial fisheries, 2014-2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-03, Anchorage.

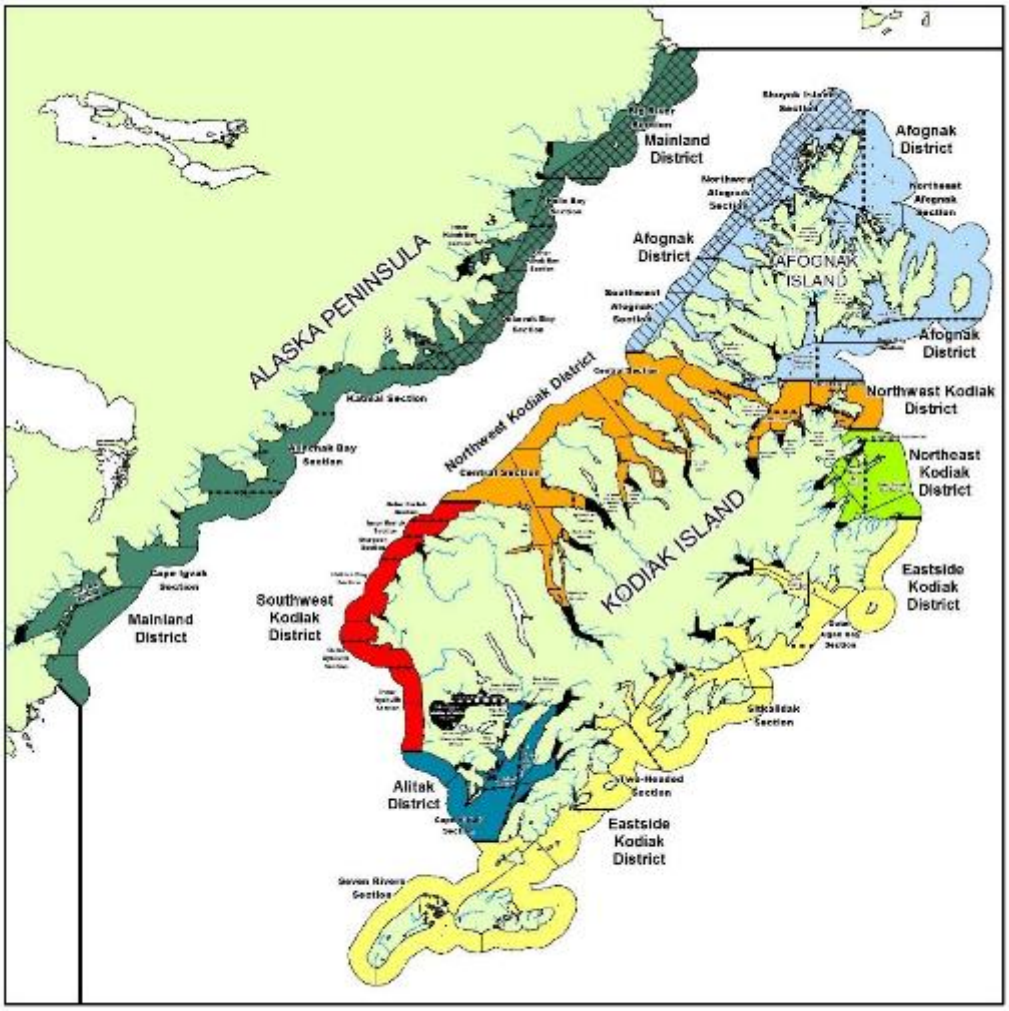
Shedd, K. R., T. H. Dann, M. B. Foster, and C. Habicht. 2016. Addendum to FMS 16-03: Redefinition of reporting groups by combining Ayakulik and Frazer into one group for the genetic baseline of North American sockeye salmon for mixed stock analyses of Kodiak Management Area commercial fisheries, 2014-2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-05, Anchorage.

Shields, P., and A. Dupuis. 2015. Upper Cook Inlet commercial fisheries annual management report, 2014. Alaska Department of Fish and Game, Fishery Management Report No. 15-20, Anchorage.

Shields, P., and A. Dupuis. 2017. Upper Cook Inlet commercial fisheries annual management report, 2016. Alaska Department of Fish and Game, Fishery Management Report No. 17-05, Anchorage.

Shields, P., and A. Frothingham. 2018. Upper Cook Inlet commercial fisheries annual management report, 2017. Alaska Department of Fish and Game, Fishery Management Report No. 18-10, Anchorage.

Yanusz, R. J., R. A. Merizon, T. M. Willette, D. G. Evans and T. R. Spencer. 2011. Inriver abundance and distribution of spawning Susitna River sockeye salmon Oncorhynchus nerka, 2008. Alaska Department of Fish and Game, Fishery Data Series No. 11-12 Anchorage.



Review of Shedd et al. (2016): *Genetic Stock Composition of the Commercial Harvest of Sockeye Salmon in Kodiak Management Area, 2014-2016*

Report to the Kodiak Salmon Workgroup

Harold J. Geiger
Terrance J. Quinn II

September 11, 2017

Executive Summary

The Kodiak Salmon Workgroup contracted us[1] to provide a scientific review of the report by Shedd et al. (2016) entitled *Genetic Stock Composition of the Commercial Harvest of Sockeye Salmon in Kodiak Management Area, 2014-2016*. This review consists of an examination of the scientific merit of the study, its utility compared to previous studies, an interpretation of how the results should be viewed in terms of the magnitude of interceptions of Cook Inlet sockeye salmon in the Kodiak Management Area's commercial fisheries, and thoughts about further investigations that may shed additional insight into Kodiak and Cook Inlet stock compositions of sockeye salmon.

Our primary findings:

1. From the point of view of fishery policy, the most important statistic is the *stock-specific harvest rate*, which is not reported in the Shedd et al. (2016) document for stocks outside the Kodiak Management Area. What is reported is the *stock-specific contribution rate*. Stock composition estimates represent the proportions of a catch that was made by various stocks in a particular spatial and temporal stratum or groups of strata. In contrast, the harvest rate describes the proportion of an annual return that was harvested in a fishery or group of fisheries. Consequently, a fishery may show a large contribution rate for a stock, but the total effect on that stock may be quite small. We illustrate this phenomenon below.
2. The new genetic stock composition approach used in this study is superior to other approaches used in the past, because the real stock composition is estimated rather than inferred from less reliable measurements (e.g., length composition). The use of a Bayesian modeling approach to estimate stock composition is state-of-the-art and allows for the appropriate treatment of random variability due to both random error caused by sampling the fishery mixture and also from the sampling of the contributing stocks.
3. The stratified sampling design used is appropriate with respect to accuracy and precision of stock composition (relative and absolute). It is clear that the authors devoted substantial attention to implementing the sampling design with the intent of obtaining a random or representative sample within combinations of major regional and temporal strata. Further information would be desirable about how the implementation was conducted on finer spatial and temporal scales to justify the assumption of a random or representative sample. For example, how was an individual fish selected for genetic sampling and were there protocols established to prevent selecting fish with particular physical characteristics, such as size?
4. Similar to past studies, results from the study revealed substantial variability in stock composition across years, among spatial strata, and among temporal strata. Further study may be desirable to determine if there are consistent patterns in this variability across years, spatial strata, and temporal strata. Continued genetic sampling and analysis in the future would thus be desirable.

Introduction and Overview

We were asked to provide a scientific review of the Shedd et al. (2016) titled *Genetic Stock Composition of the Commercial Harvest of Sockeye Salmon in Kodiak Management Area*. This

[1] See brief biographical statement in Appendix A

complex 154-page report describes an extensive genetic analysis followed by a statistical analysis of the genetic data for Kodiak area fisheries in catch years 2014, 2015, and 2016. The principal genetic tools that were used for this study were the single nucleotide polymorphism, or SNP, approach. Here we will comment on scientific criticisms of the study that appear relevant, we will briefly comment on the various methods and techniques that were used, and we will offer a broad assessment of the significance of the major findings. As we will explain in more detail below, the study appears to have been carefully conducted and the numerical estimates appear to be well crafted and reliable.

The Alaska Department of Fish and Game had previously tried to use scale pattern analysis and an analysis of fish size to estimate the proportion of non-local stocks in the Kodiak Management Area. For various technical reasons neither of these techniques were very successful. In one of the last reports on the attempts to use fish size for this purpose, Vining (1996) wrote, "As the 1995 analysis indicates, this methodology continues to generate only rough estimates, some with little confidence." It is the opinion of Vining that "other techniques, such as genetic stock identification, tagging or scale pattern analysis should be evaluated for use in the future, if more precise estimates of stock composition for sockeye salmon caught within the [Kodiak Management Area] are desired." This leads us to the present genetic study by Shedd et al. (2016).

The genetic analysis of stock mixtures rests on several assumptions. The analysis starts with the definition of a *catch mixture*, because the catch is presumably made up of a mix of stocks. Importantly, the number of contributing stocks must be known, they all must be sampled, and the genetic character of each stock must be established. Next, a representative sample of the catch mixture must be drawn and the genetic character of each specimen in the catch sample must also be established. Finally, a complicated statistical algorithm can then be used to produce an estimate of the proportion of each of the stocks in the mixture by comparing the genetic characterizations of each fish in the catch mixture to the previously established genetic characterization of the contributing stocks.

A complete analysis must include a study of both the accuracy and the precision of the estimates. In this context, *accuracy* refers to the absence of any statistical bias or other kinds of systematic errors that would consistently cause specific stock estimates to be too high or low. Here *precision* refers to errors that are caused by using only a sample from the stock of origin and the catch mixture, rather than an examination of every single fish in the fishery and every single fish in the spawning stocks. Generally, accuracy is harder to study, detect, and control, while precision can generally be controlled by increasing the sample size. Also, precision is usually studied by looking at the variation from one specimen to another in the samples. Precision measures are usually offered in the form of confidence intervals, standard errors, or coefficients of variations.

Sampling Design

The goal of the study by Shedd et al. (2016) is to determine stock compositions of sockeye salmon within the Kodiak Management Area. Consequently, sampling was restricted to the Kodiak Management Area, rather than to the overall range of sockeye salmon in the western Gulf of Alaska. The authors defined six Kodiak spatial strata of interest (called subregional sampling groups) for *sampling* genetic tissues, comprised of (1) Uganik-Kupreanof, (2) Uyak, (3) Karluk-Sturgeon, (4) Ayakulik-Halibut Bay, (5) Alitak, and (6) Igvak. The first five are located around Kodiak Island, while Igvak is part of the mainland district. The Chignik

regional reporting group had combined estimates from subregions Black Lake and Chignik Lake. Four other regional spatial strata outside of Kodiak and Chignik were West of Chignik, Cook Inlet, Prince William Sound, and South of Cape Suckling. The report did not contain justification for this particular choice of spatial strata, but suggests that considerations included areas with active management and those that are used in run reconstructions to aid management.

One confusing area is that several spatial scales are referred to in the report. For *reporting* purposes (instead of *sampling*), there are a total of 14 subregional *reporting groups* listed on page 2 that constitute the entire western Alaska area. The report designates ten of these groups as *subregional reporting groups* within the Kodiak (8 subregions) or Chignik (2 subregions) *regional reporting groups*. Six regional reporting groups including those outside of Kodiak and Chignik are listed in the tables, with subregional breakdowns for the 8 Kodiak subregions and the 2 Chignik subregions. In the end the system does seem to be consistent; however, we recommend a simpler and clearer description of spatial divisions. *These definitions of spatial strata must be understood to understand the tables and figures of results, which include both regional reporting groups and subregional reporting groups.*

The report indicates that temporal strata are also considered in combination with the spatial subregional strata: Early, Middle, and Late (see page 3 in the Shedd et al. (2016) report. The temporal strata are consistent with patterns that have been observed in past studies.

The sample size goal was to extract 380 tissue samples from each time-area stratum; no reference was provided for this number. The sampling within temporal strata was intended to be proportional to daily abundance. When this was not possible, the total sample size was obtained by sampling days with sufficient additional samples at random until the total of 380 was achieved, a reasonable approach.

We could not determine if sampling was representative within spatial strata, although the intent of the authors appears to be sampling proportional to harvest, a reasonable goal. It would be helpful to have a brief description elaborating the protocol used to achieve this goal.

The sampling design most appropriate for multiple strata with high variation among strata, to obtain high precision and accuracy, is stratified random sampling (Thompson 2016). In the future it would be desirable to show that high variation is present and the improvement in precision by using stratification over simple random sampling. One advantage to using a proportional allocation of sample size with respect to within stratum variation is that different choices for strata are not likely to produce inaccurate estimates. Nevertheless, it is not necessary to use proportional sampling to justify the use of stratified sampling in terms of accuracy, as long as a representative sample is obtained within each stratum. In particular, the use of a fixed sample size of 380 for all spatio-temporal strata is completely acceptable. (Although it may not be the most efficient allocation scheme, it does not induce estimation bias.)

The use of stratified random sampling also has a desirable product in that both relative and absolute stock compositions can be estimated both for individual strata and for combinations of strata, including that portion of the entire Kodiak Management Area that was sampled (not every single fishery was sampled). The main reason for this ability is that catches are known for all spatio-temporal strata. This is one fundamental principle that

makes estimation across strata intuitive, accurate, and precise, because relative stock compositions are projected to the total catch to get absolute stock compositions by strata that can then simply be summed across a set of strata of interest.

An additional feature of the sampling design is a set of data quality control procedures regarding the genetic data to avoid the inclusion of erroneous data into the analysis (pages 8–9). Thus, we were unable to uncover any appreciable flaws in sampling, genetic data processing, or genetic analyses in the study.

In summary, we believe that the overall sampling design of using stratified random sampling is appropriate for the genetic analysis of estimating stock composition of sockeye salmon in the Kodiak Management Area. Further studies should be done to consider alternative stratification choices both within space and time and to justify the sample size goal of 380 samples per stratum.

Policy Issues and Stated Goals for the Study

In the introduction of the Shedd et al. (2016) report, the reader finds that the stated purpose of the study was to "sample the major sockeye salmon commercial fisheries in marine waters of [the Kodiak Management Area] from June through the end of August and use genetic mixed stock analysis (MSA) to estimate stock compositions and stock-specific harvests." Later in the report, the reader finds this statement about the goal of the project: "The overall goal of this project is to provide information that will be useful for reconstructing runs, building accurate brood tables to define escapement goals, and refining management by identifying spatial and temporal harvest patterns of *local* and *nonlocal* stocks (emphasis in the original)." Later, the reader finds four stated objectives, including "report [genetic mixed stock analysis] results of stock-specific harvests of sockeye salmon sampled from *selected* commercial fisheries in [the Kodiak Management Area], 2014—2016 (emphasis added)," and "characterize where stocks were harvested from *select* commercial fisheries (again, emphasis added)." This report did not have the express purpose of making arguments regarding allocation decisions by the Alaska Board of Fisheries.

Regardless, the study does conclusively demonstrate that sockeye salmon bound for Cook Inlet were caught in some times and in some areas in the fishing years studied. In the case of the Kodiak Area, there really was no reason to believe that the commercial harvest was made up of only single stocks that originated in the Kodiak Management Area. That is, a finding of rich stock mixtures in at least some times and areas should not have been surprising. There have been many long-standing questions about the degree to which stocks are mixed in the Kodiak Management Area. Summarizing historical tagging studies, Barrett and Swanton (1991) report that sockeye harvests in the North Shelikof Strait in the 1940s, 1970s, and 1980s ranged from 30% to 100% Kodiak fish and 0% to 59% Cook Inlet-origin fish. Moreover, Barrett and Swanton concluded there were large numbers of Cook Inlet bound fish in the North Shelikof Strait fishery in July of 1990.

Contribution Rate Versus Harvest Rate

There are two important rates or proportions that can be derived from stock composition analysis and discussed before policy-making bodies, such as the Alaska Board of Fisheries:

the *contribution rate* and the *harvest rate*. These two statistics have very different significance to management. These two rates have often been confused in conversations among fishermen, in testimony before the Alaska Board of Fisheries, and in conversations with members of the press. The percentage that each stock makes up in a mixture of stocks is called the *contribution rate* (or sometimes the *stock proportion*). For example a fishery may have harvested 50 fish, and 40 of those fish might be from Stock A, with 10 fish from Stock B. Then the *contribution rate* of Stock A is 80%=(40/50)100%. For the purposes of management that could be either high or low. But if the contribution rate was 80%, then this does *not* mean that 80% of the stock was harvested; a harvest rate can be estimated only with abundance or run-size information for the stock of interest.

A large number for the contribution rate is not necessarily important to management, but it could be. If the original size of Stock A was 10,000 fish before this harvest, then the *harvest rate* on Stock A in the catch mixture would be 40/10,000 = 0.4%—which may be considered insignificant. Alternatively, if the original size of stock A was only 150 fish before the harvest, then the harvest rate would be 40/ 250 = 27%—which would usually be considered significant from a management perspective. Although moderate-to-large contribution rate statistics can lead to misplaced anxiety or even outrage, the most important statistic for management policy is the harvest rate, which is the rate that is most clearly related to the population dynamics of a stock.

Technical Comments on Bayesian Analysis and Uncertainty Measures

The statistical analysis was carried out using the Bayesian method of Pella and Masuda (2001). We contend that this method is a reasonable approach with several advantages over the more traditional *maximum likelihood* approach. As this is a Bayesian approach, there are some differences between the interpretations of the measurements that may be confusing and unnecessarily tedious to some readers of the Shedd et al. (2016) report. In the method of Pella and Masuda (2001), the unknown contribution rates (or stock mixing proportions, as they call them) are treated as unknown random variables rather than constant and unknown parameters in the maximum likelihood approach. The analysis proceeds by simulating the probability distributions of these random quantities, with the genetic data used to help develop these distributions.

In a Bayesian analysis, uncertainty in stock contribution rates is frequently displayed by the use of *credible intervals* rather than *confidence intervals*. For example, in Table 3 of the Shedd et al. (2016) report, for the Kodiak reporting group the 90% credible interval runs from 80.9% to 88.1%. The correct interpretation of this interval is that given all of the stated assumptions, *the probability is* 90% that the true value is found between 80.9% and 88.1%, given a list of assumptions. Many people, incorrectly, think this is exactly what a 90% confidence interval is, but this is a mistake for some technical, statistical reasons. For the purposes of readers of this report, we note that the Bayesian results will often closely approximate the more traditional results (Pella and Masuda 2001), so that there should be no harm in simply interpreting the Shedd et al. (2016) credible intervals as the more familiar 90% confidence intervals to investigate uncertainty in the stock composition estimates. While every one of the assumptions that underpin the analysis is probably not strictly true, these intervals do seem to be a very reasonable guide to the precision in the estimates. Based on the reported credible intervals and based on the assumptions stated in the report,

the Shedd et al. (2016) estimates appear to be both accurate and precise enough for the purposes of the study.

The Results

In trying to understand the results of the analysis, readers of the Shedd et al. (2016) report may find Figures 8 through 19 helpful, especially when paired with the maps provided in Figures 1–7. Figures 8, 10, 12, etc. (the even-numbered figures) show the estimated contribution rates (or stock mixing rates) for stocks using two levels of detail for the authors' *subregional* and *regional reporting groups* mentioned above. These estimates are then reported by specific time-area catch strata. At the highest level of aggregation there are six regional reporting groups, or what might be considered stocks in the broadest sense: (1) West of Chignik, (2) Chignik, (3) Kodiak, (4) Cook Inlet, (5) Prince William Sound, and (6) South of Cape Suckling. These groups may be the most useful for discussions about fishery management policy. Additionally there are estimates for 10 specific subregional reporting groups, or what might be considered stocks in a more narrow sense, in the Westward Region, and these estimates may be more useful for actual managers or to look at the reasonableness of some of the estimates. Similarly, the odd-numbered figures (Figures 9, 11, 13, etc. in Shedd et al. (2016)) have the stock contribution rates re-expressed as the stock-specific *number of fish harvested* (compared to rates in the previously mentioned figures) in the mixtures.

The usual pattern in these figures is that the majority of the fish harvested in each time-area grouping originated in the Kodiak management area. There are some notable exceptions, especially in 2015. For example, in the Ayakulik-Halibut Bay area, a large fraction of the fish were classified to be of Cook Inlet origin, especially in 2015 during the July 4 to August 1 period (Figure 14 in the report by Shedd et al. (2016)). When viewed in terms of numbers of fish, rather than proportions, the effect looks even stronger (Figure 15). In the Alitak district the catches of fish classified to Cook Inlet exceed the number of fish classified to the Kodiak area in two years: 2015 and 2016. Here too, the effect looks even stronger when views as the number of fish harvested 2015 (Figure 17). However, when summing over time and area, in all study years fish of Kodiak area origin dominate the catch, although catches of Cook Inlet-origin fish increased in 2015, and to a lesser extent, remained high in 2016, when compared to 2014 (Figure 20 in Shedd et al. (2016)).

Questions about why the harvest of Cook Inlet fish might be higher or lower in specific times or areas are beyond the scope of this review. One obvious question is could this variation in the proportion of Cook Inlet-origin fish be due to variation in the sizes of sockeye salmon runs in Cook Inlet?

To get at this question we simply ignored Lower Cook Inlet and brought together run size estimates for Upper Cook Inlet (Alaska Department of Fish and Game, retrieved August 17, 2017), together with the Shedd et al. (2016) estimates of the harvest of Cook Inlet bound fish in the Kodiak Management Area (taken by eye from Figure 20 or from Tables 67–69). As a point of reference, Stopha (2017) projected that approximately 0.3 million sockeye salmon would be returning to hatcheries in Lower Cook Inlet 2017. We assume that the times and areas sampled by Shedd et al. (2016) represent areas where interceptions of Cook Inlet fish would have been considered to be most likely, although we do not know that is true. Here again, as a point of reference, the total fish accounted for by the six Regional Reporting

Groups in Tables 67–69 was about 50%–60% of the total reported harvest for the Kodiak Management Area for the three study years (catch numbers from Munro 2015 and later reports in this series). Even though not all times and areas in Kodiak Management Area were sampled and even though there was some sockeye salmon production in Lower Cook Inlet, we expect that the Shedd et al. sockeye salmon catch estimates of Cook Inlet bound fish caught in the Kodiak Management Area divided by the estimated Upper Cook Inlet run size to provide a crudely reasonable—even if slightly too low—approximation to the harvest rate on Cook Inlet-origin fish harvested in the Kodiak Management Area (Table 1).

Although there are only three years available for comparison, it does not appear that changes in run size explain the difference in harvest rates on the Cook Inlet stocks. The highest harvest rate on Cook Inlet stocks was in 2015, the year with the highest in-Inlet run size among the three study years, but the second highest harvest rate is on the year with the lowest run size (Table 1 below).

Table 1. Upper Cook Inlet run size in millions of sockeye salmon **(A)** (from ADF&G), the estimated harvest of Cook Inlet-origin sockeye salmon caught in the Kodiak Management area in millions of fish **(B)** (From 67–69 in the Shedd et al. (2016) report), and the approximate harvest rate (estimated harvest in the Kodiak Management Area divided by the in-Inlet run size plus the harvest in the Kodiak Management Area) on Cook Inlet-origin sockeye salmon in the Kodiak Management Area **(C)**.

	(A) Cook Inlet run size	**(B)** Cook Inlet catch in KMA	**(C)** Approximate harvest rate
Year	(millions)	(millions)	in KMA
2010	5.71		
2011	8.68		
2012	6.46		
2013	5.74		
2014	5.54	0.1	2%
2015	6.29	0.6	9%
2016	5.04	0.4	7%

Another important question: were the harvests of Cook Inlet-bound sockeye salmon excessive? Though this is a policy judgment, rather than a scientific question, we note that in the years 2014-2016, the estimated *harvest rate* ranged from 2% to 9%, and did not reach or exceed 10% in any year in the study (Table 1). Some might point out that the way we calculated the harvest rate under-represents its true magnitude—and the estimates in Table 1 very well may be too low. Even so, it would be highly unlikely we have underestimated it by a factor of 2, meaning that the median harvest rate over the three study years would have been almost surely less than 15%, and probably considerably less.

Are there areas where the proportion or numbers of Cook Inlet-origin sockeye salmon are higher than in other areas? Figures 22, 23, and 24 in the Shedd et al. (2016) report are useful for speculating about this question—although it is really impossible to establish a trend with only three years of data. Notice that the area with the highest number of Cook Inlet-origin fish was Ayakulik-Halibut Bay in 2014 and again in 2015. However, in 2016 the number of Cook Inlet-origin fish in this district was much reduced from the previous year, and a larger number of Cook Inlet-bound sockeye salmon was caught in the Igvak area—which had previously been an area with very few Cook Inlet-origin fish harvested.

When time is brought into the discussion the situation also appears murky. The proportion of Cook Inlet-origin fish caught in the Uyak area is relatively low in all sampling periods in 2014 (Tables 15, 16, and 17 in the Shedd et al. (2016) report, yet the proportion rises to relatively high levels (54% and 32%) in the second and third sampling periods in 2015 (Tables 20 and 21). Then in 2016, the proportion was much reduced, with over 80% of the fish harvested in each period in this catch area belonging to the Kodiak reporting group (Tables 23, 24, and 25). This observed variation shows the danger in looking at just three years and thinking that one sees a trend. Further sampling and study is warranted to understand patterns of temporal variation.

The proportion of Cook Inlet-origin fish in the Ayakulik-Halibut Bay area is relatively low (less than 8%) in the first sampling period (June 1 to June 27) in 2014, but that this rises to 24% in the second period (June28 – July 25) of that year, and then falls to about 5% in the last sampling period of that year (Tables 39, 40, and 41). However, in the next year this proportion starts high in the first period (28%), rises to 48% in the second period, and then drops to less than 10% in the last period (Tables 43, 44, and 45). In 2016, the first period contains essentially all fish originating from the Kodiak Management Area (>99%; Table 47), but the proportion of Cook Inlet-origin fish again rises in the second period to nearly 42%, and remains high at 28% in the third period (Tables 47, 48, and 49). A person focusing on the similarities would note that the second sampling period for this district was consistently high in all three sampled years, and that is correct. However, someone focusing on the large year-to-year variation in the proportion of Cook Inlet-origin fish would correctly point out that with three data points it is premature to speculate that this pattern will continue into the future.

Final Comments

The Shedd et al. (2016) report is generally well written, organized, and it offers a reasonable amount of specific details about the actual genetic and statistical analyses. While it is impossible to judge the care, attention to detail, and technical skill that actually went into actual genetic analysis from the written page, the report demonstrates a great deal of

technical sophistication. The sections on "Laboratory Quality Control" appears to demonstrate that the authors did take reasonable care to detect and report on obvious mistakes. The Alaska Department of Fish and Game's Gene Conservation Lab has an excellent reputation for this kind of work. It would be extremely surprising to find that many, if any, outright mistakes were made in either the genetic or the statistical analyses.

The estimates in the Shedd et al. (2016) report seem quite reasonable. Catches were generally dominated by fish that originated within the Kodiak Management Area. Although there are some exceptions, a finer-scale examination shows catches were generally dominated by stocks that originated near the area of harvest. The Shedd et al. (2016) report is technically sophisticated and it contains features that we have found are indicative of a study that is carefully conducted. We found no reason to think that there were any large inaccuracies in the study, and the reported measures of precision provide evidence that the reported estimates are trustworthy and suitable for their intended purposes.

Finally, we note that the estimated harvest rate on Cook Inlet-bound sockeye salmon were below 10% in each year, and substantially below 10% in one year. These harvest rates generally agree with what previous, less accurate studies, have suggested. However, with only three years of measurements, with a large fraction of the catch not sampled, and with large annual variation in those measurements (much larger than the error obtained from the credible intervals), it is very hard to conclude that these results bracket the range of what to expect if the study were to be repeated, or to conclude that these results represent what would happen in a "typical year" (if there ever is such a thing). We recommend that the genetic analyses in this study be conducted to better understand the apparently real variation in stock contribution estimates (both rates and harvests).

These estimates in Shedd et al. would have been more useful for policy discussions if they could be recast in terms of harvest rate rather than contribution rate. In fairness, we note that this was not one of the stated goals for the study, but this appears to be a subject that needs to be addressed in the future. We have tried to crudely approximate the harvest rate using information that was easily accessible to us. While our specific harvest rate estimates can be easily criticized, it is clear that the harvest rate was probably much less than 10% in most study years and almost surely less than about 15% in each year of the study. In the future, we recommend sampling in some of the time and area strata that were not sampled in 2014–2016, or else we recommend some discussion of why specific time-area strata can be assumed to have very low contribution rates for stocks outside the Kodiak Management Area.

Acknowledgments

We thank Heather McCarty for her help in proposing this review and guidance into the scientific and management issues involved.

References

Barrett, B.M. and C.O. Swanton. 1991. Origins of sockeye salmon in the Kodiak Management Area North Shelikof Fishery, 6 July through 25 July, 1990. Regional Information Report 4K91-3. Alaska Department of Fish and Game, Kodiak, Alaska.

Munro, A. R., editor. 2015. Run forecasts and harvest projections for 2015 Alaska salmon fisheries and review of the 2014 season. Alaska Department of Fish and Game, Special Publication No. 15-04, Anchorage.

Pella, J. and M. Masuda. 2001. Bayesian methods for analysis of stock mixtures from genetic characters. Fishery Bulletin 99:151–167.

Stopha, M. 2017. Alaska fisheries enhancement annual report 2016. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 5J17-04, Anchorage.

Vining, I. 1996. The use of average weight to estimate the level of harvest of non-local sockeye salmon within the Kodiak Management Area during July 6–25, 1983–1995. Regional Information Report 4K96-28. Alaska Department of Fish and Game, Kodiak, Alaska.

Appendix A – Biographical Statements for the Authors

Harold J. Geiger is the chief scientist for the St. Hubert Research Group, a small consulting company in Juneau, Alaska. He previously worked for the Alaska Department of Fish and Game, holding several positions on the salmon research staff of the Division of Commercial Fisheries before retiring in 2007. He held the position of Chief Biometrician in the late 1990s and was the Salmon Research Supervisor for the Southeast Region in the early 2000s. He holds a Master's degree in Statistics from Oregon State University and a PhD from the College of Fisheries and Ocean Sciences at the University of Alaska Fairbanks.

Terrance J. Quinn II, Ph.D. has been Professor of Fish Population Dynamics in the Fisheries Department, College of Fisheries and Ocean Sciences, University of Alaska Fairbanks for 32 years. He obtained his Ph.D. in Biomathematics from the University of Washington in 1980. Dr. Quinn's research focuses on fish population dynamics; estimation of fish and whale abundance; sampling theory; and renewable resource management systems. He is the co-author or co-editor of 4 books and over 100 scientific publications and has shepherded about 40 students through their post-graduate careers. He has been a member of the Statistical and Scientific Committee of the North Pacific Fishery Management Council since 1986 and was a former chair of that body. He is a former member of the Ocean Studies Board of the National Academy of Sciences and served on five of their committees, including two as chair or co-chair. He is an Associate Editor of the Canadian Journal of Fisheries and Aquatic Sciences.

Appendix B: Some Comments on Stock Mixture Analysis

The earliest techniques for developing these estimates were based on simply capturing migrating salmon, tagging them with a visible tag, and then looking for the tags on spawning fish. By comparison, this is a crude technique as it is hard or even impossible to control for how much effort went into looking for tags. That is, a stock with a small contribution to the mixture could result in a large fraction of the recovered tags if, for example, there was a counting weir on the spawning stream of that stock.

A technique that is somewhat more sophisticated is based on an analysis of scale patterns, and this technique was used extensively in the 1980s and 1990s. The technique was based on the assumption that fish originating from different systems had different growth patterns,

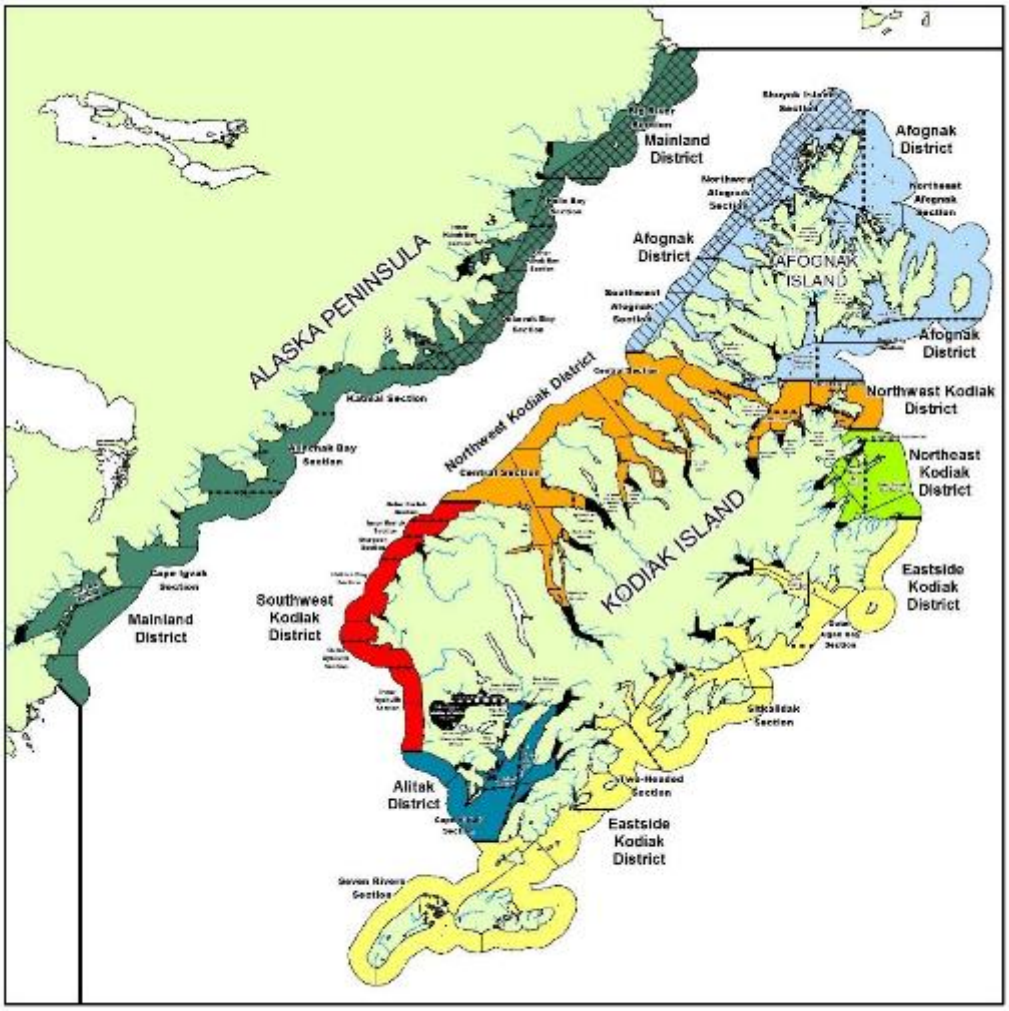
which would be represented on the scales of the fish. A large sample of scales needed to be collected for each stock, each year. Then a very large (often over 100 measurements) can be used to characterize the scale pattern for that stock, as the growing conditions that affect the scale patterns change from year to year. A complex statistical algorithm (called a linear discriminate function) is used to look for the specific measurements that show the most differences among stocks. The results from this discriminate function can then be used to classify fish in the fishery mixture to the stock that most likely produced it.

In Lynn Canal in Southeast Alaska, scale patterns were used to estimate the proportions of Chilkat and Chilkoot Lake sockeye salmon in a mixture to both actively manage a gillnet fishery during the fishing season and to study the productivity of the stocks after the fishing season. This was an ideal situation as the number of stocks was small and the patterns were quite different. As the number of stock in the mixture increased beyond just a few, or as the growing conditions among the stocks were more similar, scale pattern analysis estimates become uncontrollably imprecise, and the accuracy of the estimates would also degrade.

In the 1990s, genetic tools showed obvious advantages over other techniques. The first genetic techniques are sometimes called the allozyme techniques. Although these were time consuming and expensive, one of the main advantages was the individual stocks no longer needed to be characterized each year, as the genetic character of the stock changed slowly, if at all. Later, microsatellite techniques replaced allozyme techniques for a number of technical reasons. Finally, the SNP (Seeb et al. 2011) approach, used in this study, is usually thought of as the current state of the art and most cost-effective method of conducting a complex stock mixture analysis.

Reference

Seeb, J. E., G. Carvalho, L. Hauser, K. Naish, S. Roberts, and L.W. Seeb. 2011. Single-nucleotide polymorphism (SNP) discovery and applications of SNP genotyping in nonmodel organisms. Molecular Ecology Resources, 11: 1–8. doi:10.1111/j.1755-0998.2010.02979.x



Gulf of Alaska Climate Conditions and Sockeye Salmon Run Timing During 2014-2016

Report to the Kodiak Salmon Work Group

Michael A. Litzow, PhD

Executive Summary

During 2014-2016, staff from the Alaska Department of Fish and Game sampled sockeye salmon in Kodiak Management Area commercial catches to estimate stock-specific contribution rates to the fishery (Shedd et al. 2016). The authors of that report cautioned that "these analyses represent environmental and fishery conditions during a specific period of time…caution must be exercised when extrapolating the results to years, areas, and temporal periods not analyzed because changes in relative abundance among reporting groups, prosecution of fisheries, or migratory behavior due to ocean conditions very likely affect distribution of stock-specific harvests among fisheries" (p. 23).

The current report[2] evaluates the conditions during the years of the genetics study (2014-2016) in order to summarize how well that study may represent "typical" conditions for Gulf of Alaska sockeye runs. The specific goals of this report are to 1) review the state of ocean climate conditions during 2014-2016, 2) evaluate the evidence for effects on sockeye salmon migration and run timing during these years, and 3) summarize implications for applying the findings of the Shedd et al. (2016) genetics study as justification for making changes to sockeye salmon fisheries management in future years.

The primary findings of this work are as follows:

1. **The "Warm Blob" climate event dramatically affected ocean physics across the North Pacific during 2014-2016.** These years were characterized by unprecedented climate conditions in the Gulf of Alaska. Sea surface temperatures and air temperatures were at or beyond previously-observed maxima. River temperatures in South Central Alaska were also higher than ever observed, and river flow volumes were unusually low. Summer sea level pressure was unusually high, which led to reduced wind mixing of ocean water.
2. **Many unusual ecosystem responses were observed in the Gulf of Alaska during 2014-2016**, highlighting the strong effects that unusual climate conditions had on populations and communities at all taxonomic levels, from plankton to fish, seabirds, and marine mammals.
3. **Sockeye salmon showed unusual run timing during 2014-2016.** Catches and escapement were later than usual in many areas, both in Kodiak and Upper Cook Inlet. At the same time, some runs, such Kasilof River sockeye, were earlier than usual. Since no data on at-sea migration patterns of sockeye salmon are available for these years, these findings provide the best available information concerning sockeye salmon migration during 2014-2016, and suggest the possibility for unusual patterns of stock mixing.
4. **Unusual sockeye run timing is directly linked to unusual climate conditions.** The link between climate conditions and run timing is highly nonlinear and accelerating. In general, warmer conditions and increased atmospheric pressure during 2014-2106 were directly related to a tendency towards later overall run timing in sockeye salmon, although some runs were also unusually early.
5. **The rate of physical and biological change currently occurring in the Gulf of Alaska is unprecedented, and suggests the need for caution when re-evaluating long-standing management practices based on a few years of data.** Biological responses to climate disturbance are complex and often time-lagged. The trajectory of fisheries change in the Gulf

[2] See Appendix A – Biographical Statement

of Alaska is therefore impossible to predict, but given the size of the ongoing climate disturbance, the full range of fisheries responses has likely not yet played out. Data from 2014-2016 are likely to be a snapshot of a rapidly changing system, and given the potential impacts of physical conditions on stock mixing, are likely to quickly become outdated as unusual climate conditions continue.

Conclusion: The Gulf of Alaska is currently undergoing rapid change outside the envelope of historical conditions. In this situation, the ability of data from 2014-2016 to serve as a reliable guide for future conditions is highly questionable. These considerations are exactly in line with the caution provided by Shedd et al. (2016) concerning the use of their data in situations materially different from those under which the study took place, and suggests the need for a precautionary approach to possible management changes based on these results.

Background

Unprecedented high atmospheric pressure over large areas of the North Pacific in winter 2013-14 led to reduced wind mixing and Ekman transport, so that normal ocean cooling at the end of summer failed to occur. This event persisted into 2016, and became known as the "Warm Blob" (Bond et al. 2015). In terms of duration, size of area affected, and degree of warming involved, this event became the strongest marine heatwave ever observed globally (Di Lorenzo and Mantua 2016, Hobday et al. 2018). In the Gulf of Alaska, temperatures during 2014-2016 were by far the highest in the historical record (Fig. 1). After a hiatus in 2017, unusually warm temperatures returned in 2018-2019, and warm temperatures are expected to intensify over coming decades (Walsh et al. 2018). The best scientific understanding is therefore that the Gulf of Alaska is entering a period of persistent change.

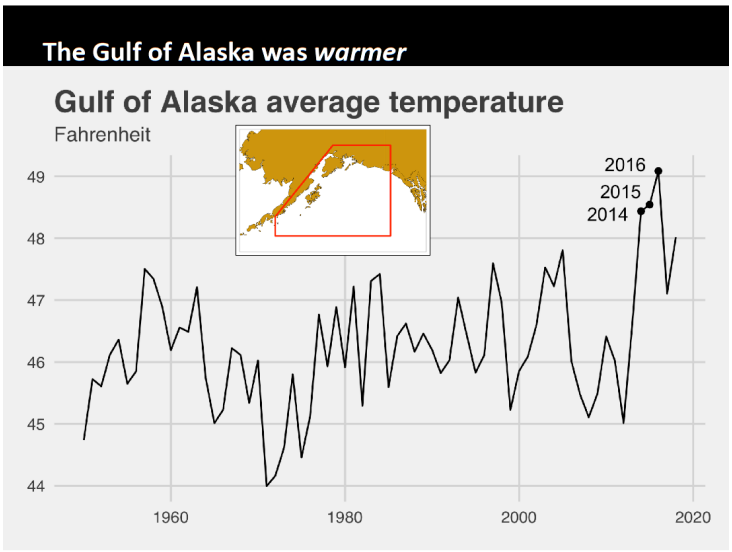


Fig. 1. Gulf of Alaska sea surface temperature (annual means), 1950-2018. Data from NOAA Extended Reconstructed SST v5.

A suite of other highly unusual climate conditions also occurred during 2014-2016 in the Gulf of Alaska. These included air temperatures and river temperatures that were at or above previous historical record high values (Fig. 2). And, in line with the high atmospheric pressure that was the immediate cause of the Warm Blob event across the North Pacific, atmospheric pressure at sea level was generally elevated over the Gulf of Alaska during 2014-2016 (Fig. 3). This high atmospheric pressure was associated with unusually weak wind mixing and wind-driven currents in the Gulf of Alaska ecosystem.

Salmon migration patterns are known to be highly sensitive to physical factors such as ocean temperature, ocean currents, river volume and river temperature (Quinn and Adams 1996, Hodgson and Quinn 2002, Hodgson et al. 2006). Sockeye runs in Cook Inlet are particularly prone to shared patterns of variability in run timing – in other words, unusual migration behavior tends to affect runs across Cook Inlet as a group (Hodgson et al 2006). Given the known sensitivity of salmon migration behavior to physical conditions, the climate event in the Gulf of Alaska has important potential implications for changing patterns of stock mixing in sockeye salmon.

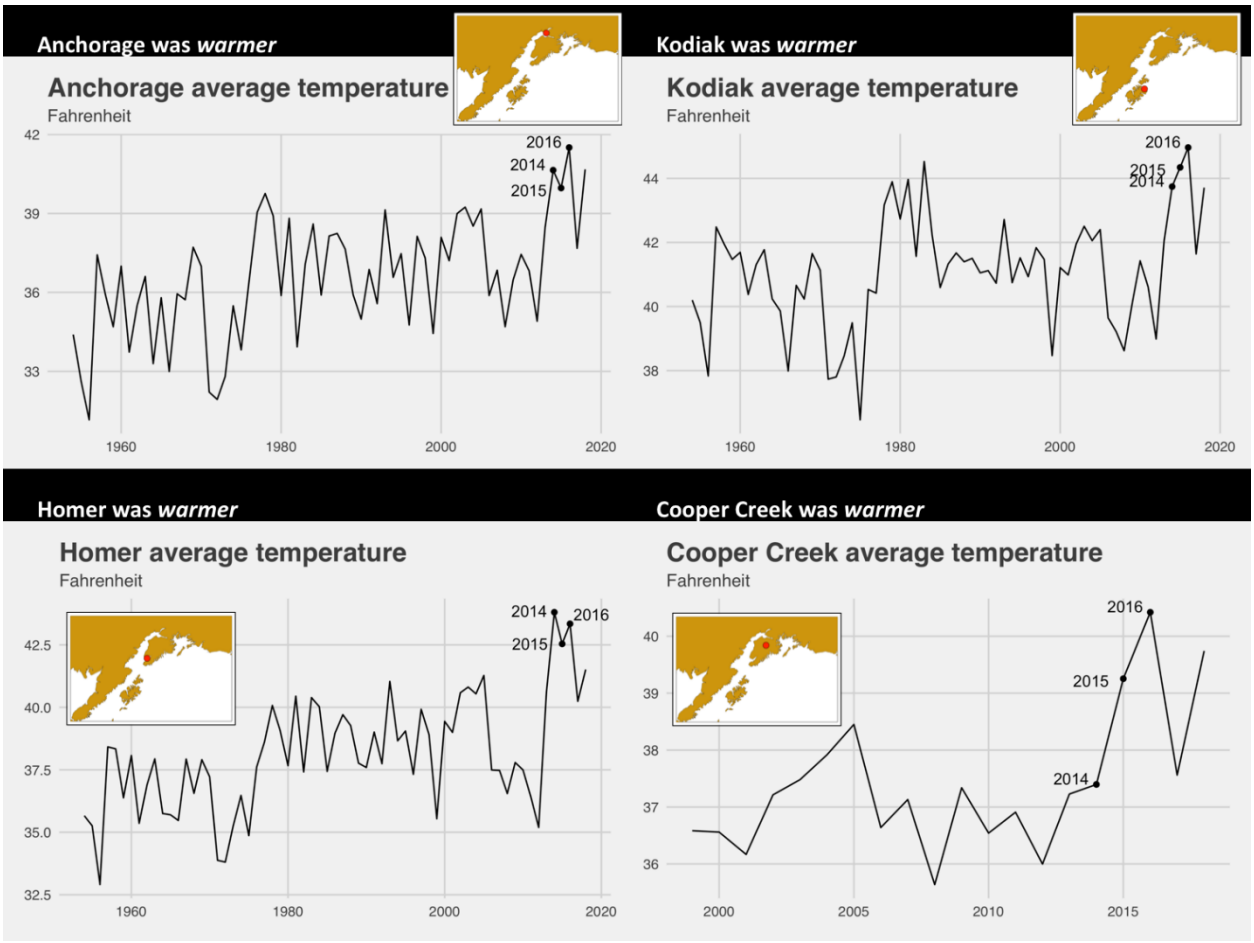


Fig. 2. Unusual air and river temperatures in Southcentral Alaska during 2014-2016.

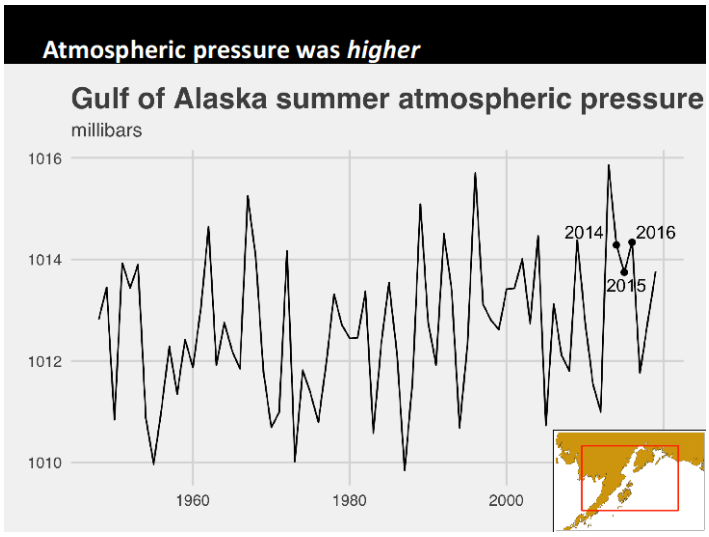


Fig. 3. Summer atmospheric pressure over the Gulf of Alaska, 1950-2018.

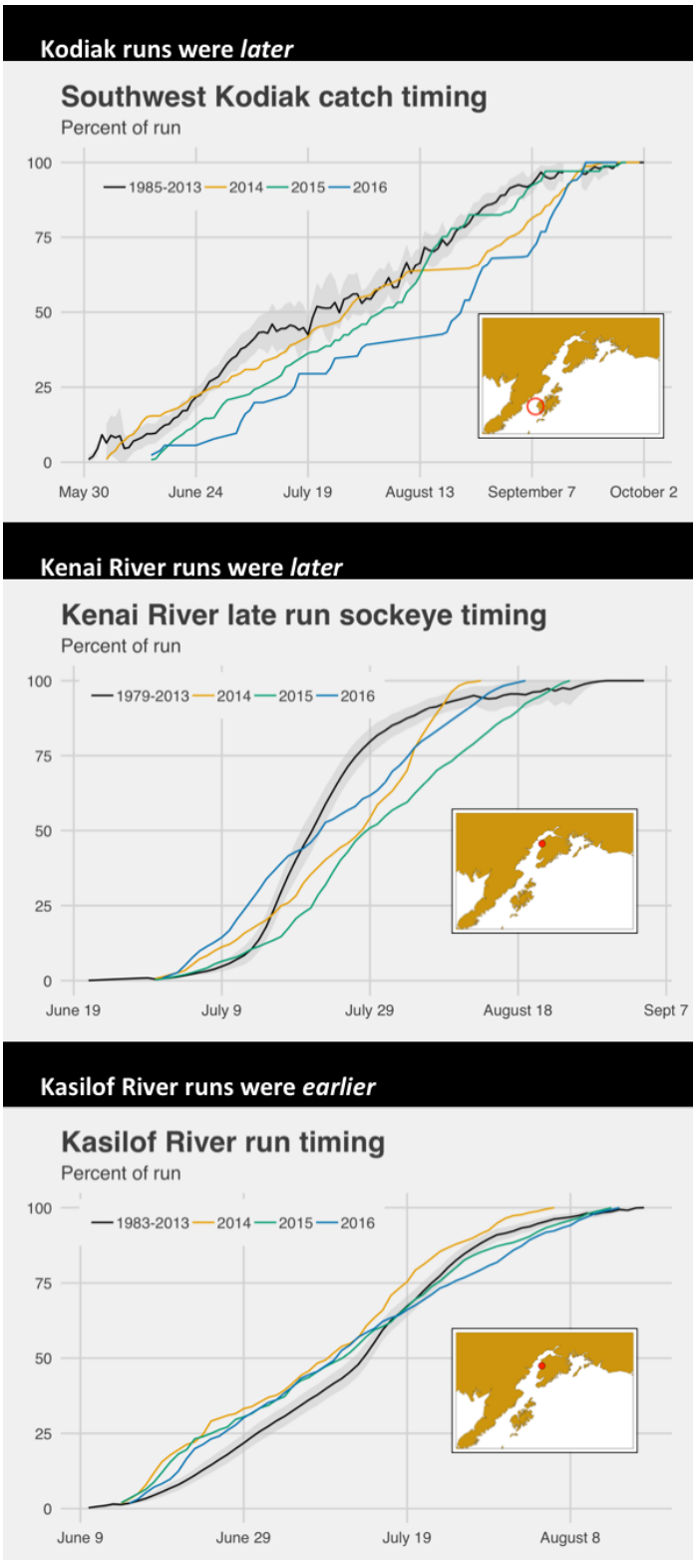


Fig. 4. Run timing of Southwest Kodiak, Kenai River, and Kasilof River sockeye salmon during 2014-2016 compared to long-term means.

Linking Ocean Temperate and Sockeye Run Timing

At-sea migration patterns in salmon remain poorly understood, and no data are available concerning the distribution and timing of Gulf of Alaska sockeye salmon returning to natal rivers during the period of interest. However, extensive records are available for the timing of commercial catches and escapement for important stocks, and these data provide the best available information for understanding recent changes in sockeye migration. Sockeye salmon run timing was estimated for this report with data on both escapement from a variety of Gulf of Alaska runs, as well as commercial catch data from both Upper Cook Inlet and the Kodiak Management Area (details in Data Sources and Methods). Several important sockeye runs showed run timing during 2014-2016 that was highly unusual when compared to long-term means (Fig. 4), suggesting that the unusual climate conditions during these years affected sockeye migration patterns.

In order to formally analyze the relationship between climate conditions and run timing, data were standardized across different long-term time series by calculating the day of the year in which 50% of the total run (catch or escapement) had occurred in each year (Quinn and Adams 1996). A Dynamic Factor Analysis (DFA) model was then used to summarize variability across the many different run timing information sources (Zuur et al. 2003). This DFA model showed evidence of shared variability (positive loadings) for Southwest Kodiak catches and Kasilof and Kenai River escapement. A variety of other data sources had weaker loadings on the shared trend (Fig. 5). The shared trend of variability in run timing showed an increasing trend since the early 2000s, with a further step increase beginning around 2014 (Fig. 6). Positive values in this

shared trend indicate a change towards later runs in time series with positive loadings, and earlier runs in time series with negative loadings.

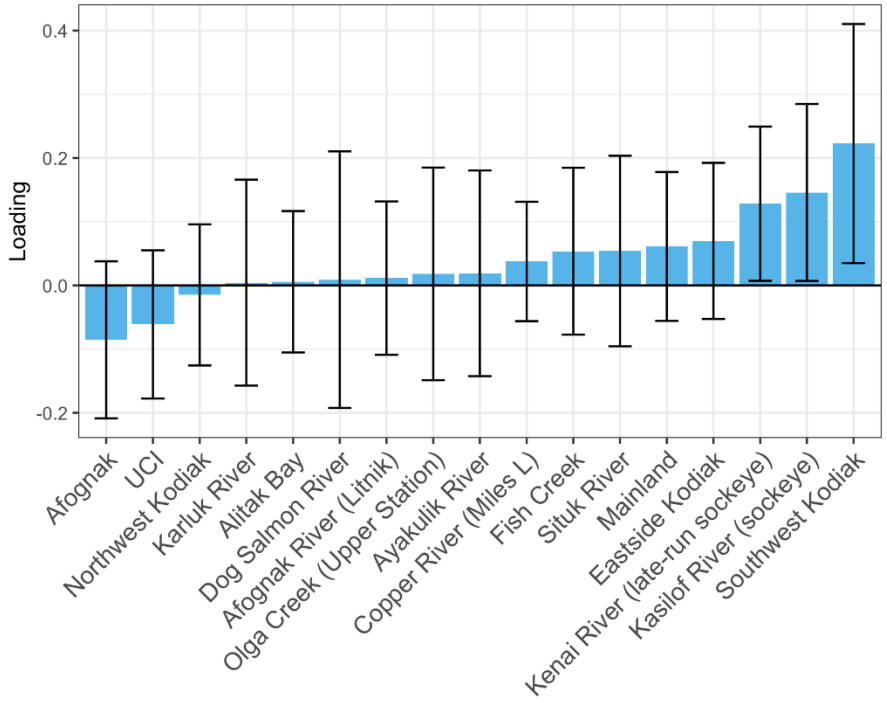


Fig. 5. Dynamic Factor Analysis summary of Gulf of Alaska sockeye salmon run timing, 1978-2019. Loadings on individual escapement and catch time series (day of year when 50% of run has occurred in each year, estimates with 95% confidence intervals). Time series with positive loadings are later when shared trend goes up; time series with negative trends are earlier when the shared trend goes up. UCI = = Upper Cook Inlet total commercial catch.

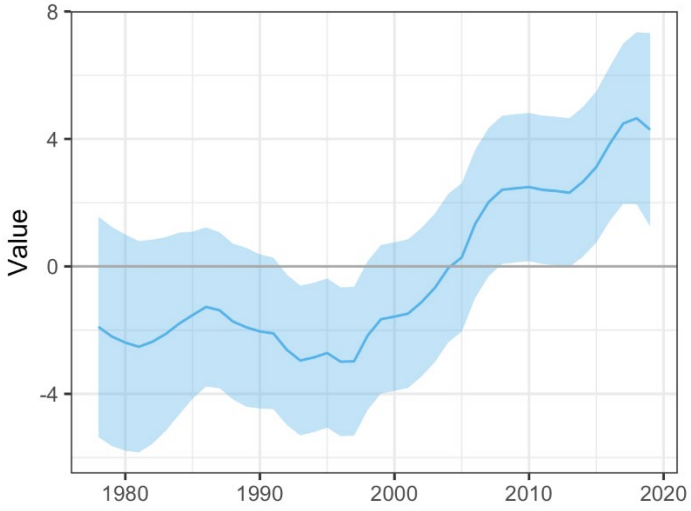


Fig. 6. Shared trend in sockeye run timing (estimate and 95% confidence interval) from DFA model. Value of 0 indicates average overall timing.

A variety of different Gulf of Alaska climate variables may influence sockeye salmon run timing, including sea surface temperature, sea level atmospheric pressure, river temperature, and river flow. A DFA model was again used to summarize variability across these different climate variables. This DFA model summarized overall climate variability as a combination of positive loadings for a range

of air, sea, and river temperature time series, and negative loadings for stream flow in Cooper Creek (Kenai River drainage) and Willow Creek (Susitna River Drainage; Fig. 7). In other words the model captures the tendency for temperatures at different sites to vary together, and for stream flow at those two Southcentral Alaska sites to decline in warm conditions. The shared trend of climate variability from this DFA model clearly shows the transition to extreme conditions since 2014 (Fig. 8).

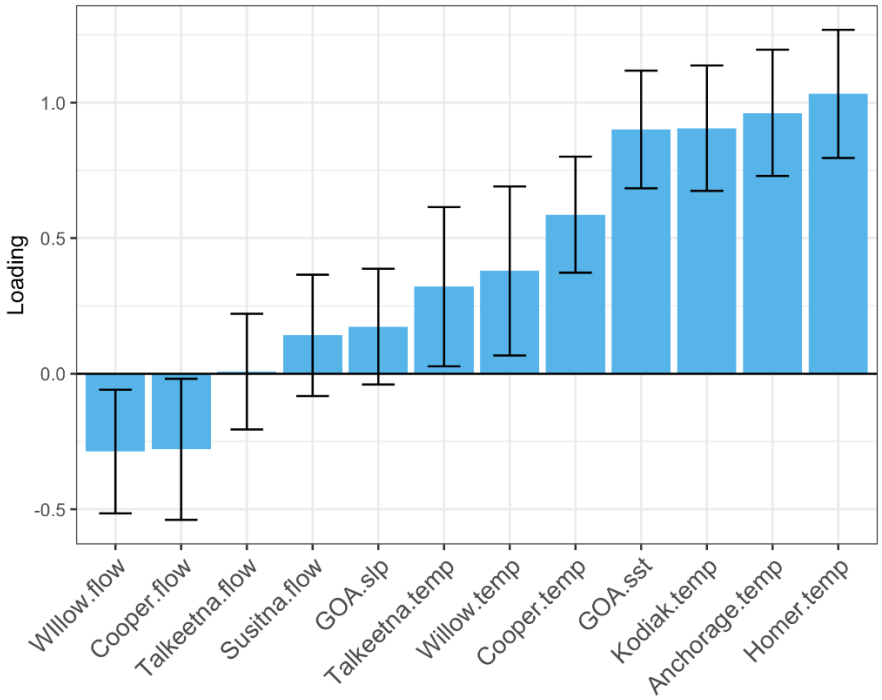


Fig. 7. Dynamic Factor Analysis summary of Gulf of Alaska and South-Central climate, 1978-2019. Loadings on individual climate time series (estimates with 95% confidence intervals). Time series with positive loadings go up when the shared trend goes up; time series with negative trends go down when the shared trend goes up. GOA.slp = Gulf of Alaska sea level atmospheric pressure, GOA.sst = Gulf of Alaska sea surface temperature.

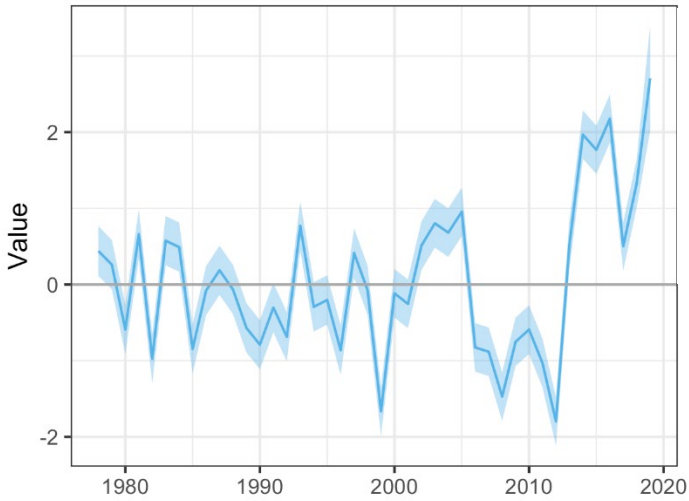


Fig. 8. Shared trend in climate variability (estimate and 95% confidence interval) from DFA model. Value of 0 indicates average conditions.

These results confirm that overall trends in both overall sockeye run timing (Fig. 6) and overall climate conditions for sockeye (Fig. 8) have been at unprecedented levels since 2014. The next step of the analysis is to evaluate the evidence that the two trends are related. An initial examination of possible driver-response relationships with a scatter plot of annual values in the climate trend and the sockeye run timing trend suggests a highly nonlinear relationship, with two distinct clusters of observations in the 1978-2019 time period (Fig. 9). This initial result suggests the possibility of two overlapping mathematical functions describing climate effects on salmon, occupying different parts of the time series. This kind of complex driver-response relationship, sometimes referred to as "alternative stable states" is a common feature of ecosystems experiencing disturbance from external factors such as climate change (Scheffer et al. 2012, Litzow and Hunsicker 2016). *This scatter plot also illustrates the highly unusual nature of the 2014-2016 period for both climate conditions and sockeye run timing: both quantities were at unprecedented levels in 2014-2016.*

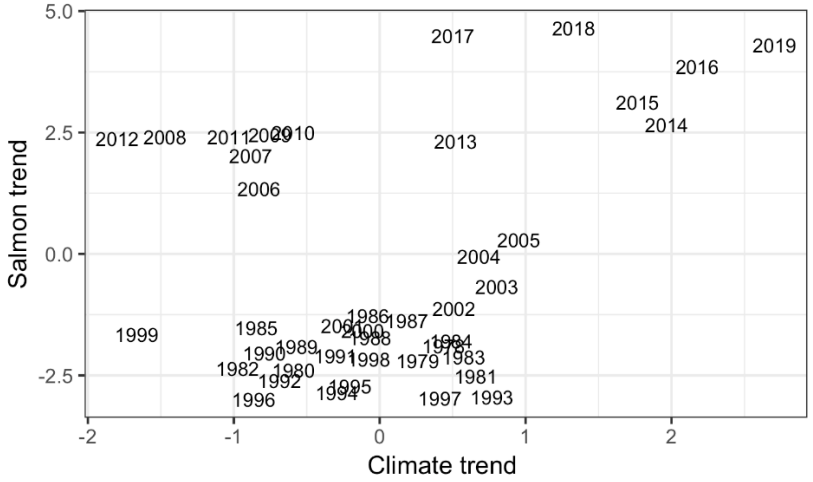


Fig. 9. Time series of climate conditions (shared trend from climate DFA model; driver variable) and sockeye run timing (shared trend from salmon DFA model; response variable).

The next step in this analysis was to test for meaningful relationships between sockeye run timing and climate state. This part of the analysis answers the question of whether there is evidence that run timing is responding to changes in the climate. This analysis used Bayesian linear regression models to determine if the slope of sockeye run timing on the shared climate trend (unit change in run timing per unit change in climate) is different from zero. These models do support the hypothesis of a meaningful relationship between climate state and run timing with an estimated slope that is clearly different from zero. These models also indicate that the relationship is strengthening over time (increasing intercept since the early 2000s (Fig. 10).

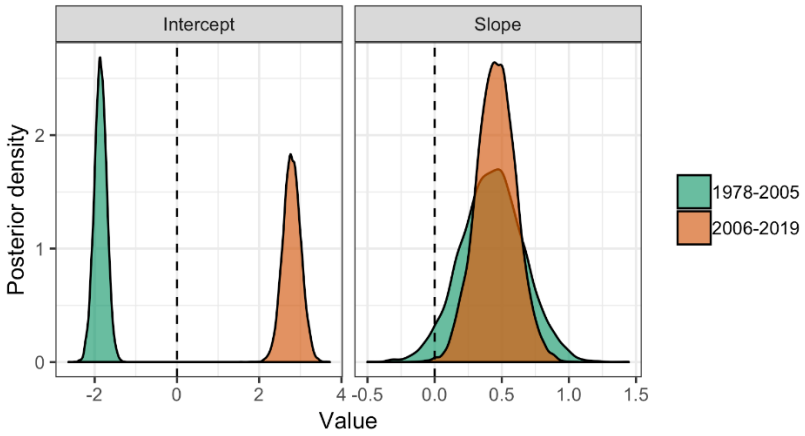


Fig. 10. Era-specific relationships between shared climate trend and shared trend in sockeye salmon run timing: posterior distributions for intercept and slope from Bayesian linear regression fit separately to data from 1978-2005 and 2006-2019.

As noted earlier, this kind of time-dependent driver-response relationship is a common feature of ecosystems experiencing external forcing (Scheffer et al. 2012), especially in instances of changing climate variables (Wolkovich et al. 2014). However, the causes of this kind of complex, nonlinear relationship are typically very difficult to determine, and understanding the apparent jump in sockeye response to climate forcing is beyond the scope of this report. What is apparent is the effect of the simultaneous change in run timing and climate: 2019 was the most extreme year on record for the climate trend, and 2017-2019 were the most unusual years on record for the shared trend in sockeye run timing, with 2014-2016 close behind (Fig. 9). In addition, a sensitivity analysis shows that similar results were obtained when only escapement time series were analyzed, indicating that management changes to catch timing do not explain changing run timing in recent years (results not shown).

Ecosystem Context

In addition to the unusual sockeye run timing noted above, a wide range of ecosystem responses to unusual climate conditions have been noted since 2014 in the Gulf of Alaska. These include the largest-ever observed mass mortality event for common murres and a variety of other chronic seabird mass mortality events; acute and chronic production of neurotoxins by harmful algal blooms (McCabe et al. 2016, Roggatz et al. 2019); significant mortality in humpback whales; unprecedented irruptions of pelagic colonial tunicates (*Pyrosoma* sp.); fisheries failures for Pacific cod and pink salmon; unusual patterns of primary productivity (spring blooms that are unusually early and small; Litzow et al. in prep), and shifts in zooplankton abundance and community structure (Litzow et al. in prep.). Taken together, these responses underscore the unusual nature of both the initial 2014-2016 Warm Blob and subsequent years, and the potential for continuing ecological change as long as the current warming event lasts.

Implications for Management

A very high degree of uncertainty currently attends ecosystem status in the Gulf of Alaska, both for the specific question of sockeye run timing and stock mixing, and for broader questions of stability in the ecosystem and fisheries. While the 2014-2016 return years were highly unusual for sockeye run timing as measured by the shared trend of run timing variability, even these extreme values have been exceeded during 2017-2019 (Fig. 3b). Given that biological responses to ecosystem perturbations such as climate forcing are complex and often lagged in time (Frank et al. 2011, Hughes et al. 2013), and that climate conditions have again returned to levels commensurate with those seen in 2016, the full scope of biological consequences of the current climate event has likely not yet become apparent. *In this situation of rapid change outside the envelope of historical conditions, the ability of data from 2014-2016 to serve as a reliable guide for future conditions is highly questionable.* The speed of change currently occurring in the Gulf of Alaska underscores the caution provided by Shedd et al. (2016) concerning the use of their data in situations materially different from those under which the study took place, and suggests the need for a precautionary approach to possible management changes based on these results.

Data Sources and Methods

Sea surface temperature data were extracted from the NOAA Extended Reconstructed Sea Surface Temperature data set (ncdc.noaa.gov). Sea level pressure data come from the NCEP/NCAR Reanalysis (esrl.noaa.gov). River temperature and river flow data come from the US Geological Survey (waterdata.usgs.gov). Air temperature data come from the Alaska Climate Research Center (climate.gi.alaska.edu). Data on sockeye run timing come both from escapement counts and commercial catch data obtained from ADF&G (adfg.alaska.gov). DFA models were fit following the recommendations of Holmes et al. (2018). Bayesian regression models were fit following the recommendations of Gelman et al. (2014).

References

Bond, N. A., M. F. Cronin, H. Freeland, and N. Mantua. 2015. Causes and impacts of the 2014 warm anomaly in the NE Pacific. Geophysical Research Letters 42:3414–3420.

Frank, K. T., B. Petrie, J. A. D. Fisher, and W. C. Leggett. 2011. Transient dynamics of an altered large marine ecosystem. Nature 477:86–89.

Gelman, A., J. B. Carlin, H. S. Stern, D. B. Dunson, A. Vehtari, and D. B. Rubin. 2014. Bayesian Data Analysis. Chapman & Hall, Boca Raton. Florida.

Hobday, A. J., E. C. J. Oliver, A. Sen Gupta, J. A. Benthuysen, M. T. Burrows, M. G. Donat, N. J. Holbrook, P. J. Moore, M. S. Thomsen, T. Wernberg, and D. A. Smale. 2018. Categorizing and naming marine heatwaves. Oceanography 31.

Hodgson, S., and T. P. Quinn. 2002. The timing of adult sockeye salmon migration into fresh water: adaptations by populations to prevailing thermal regimes. CANADIAN JOURNAL OF ZOOLOGY-REVUE CANADIENNE DE ZOOLOGIE 80:542–555.

Hodgson, S., T. P. Quinn, R. Hilborn, R. C. Francis, and D. E. Rogers. 2006. Marine and freshwater climatic factors affecting interannual variation in the timing of return migration to fresh water of sockeye salmon (Oncorhynchus nerka). Fisheries Oceanography 15:1–24.

Holmes, E. E., E. J. Ward, and M. D. Scheuerell. 2018. Analysis of multivariate time-series using the MARSS package. Seattle, USA.

Hughes, T. P., C. Linares, V. Dakos, I. A. van de Leemput, and E. H. van Nes. 2013. Living dangerously on borrowed time during slow, unrecognized regime shifts. Trends in Ecology & Evolution 28:149–155.

Litzow, M. A., and M. E. Hunsicker. 2016. Early warning signals, nonlinearity, and signs of hysteresis in real ecosystems. Ecosphere 7.

Di Lorenzo, E., and N. Mantua. 2016. Multi-year persistence of the 2014/15 North Pacific marine heatwave. Nature Climate Change 6:1042–1047.

McCabe, R. M., B. M. Hickey, R. M. Kudela, K. A. Lefebvre, N. G. Adams, B. D. Bill, F. M. D. Gulland, R. E. Thomson, W. P. Cochlan, and V. L. Trainer. 2016. An unprecedented coastwide toxic algal bloom linked to anomalous ocean conditions. Geophysical Research Letters 43:10,310-366,376.

Quinn, T. P., and D. J. Adams. 1996. Environmental changes affecting the migratory timing of American shad and sockeye salmon. ECOLOGY 77:1151–1162.

Roggatz, C. C., N. Fletcher, D. M. Benoit, A. C. Algar, A. Doroff, B. Wright, K. C. Wollenberg Valero, and J. D. Hardege. 2019. Saxitoxin and tetrodotoxin bioavailability increases in future oceans. Nature Climate Change.

Scheffer, M., S. R. Carpenter, T. M. Lenton, J. Bascompte, W. Brock, V. Dakos, J. van de Koppel, I. A. van de Leemput, S. A. Levin, E. H. van Nes, M. Pascual, and J. Vandermeer. 2012. Anticipating critical transitions. Science 338:344–348.

Shedd, K. R., M. B. Foster, T. H. Dann, H. A. Hoyt, M. L. Wattum, and C. Habicht. 2016. Genetic stock composition of the commercial harvest of sockeye salmon in Kodiak Management Area, 2014-2016. Alaska Department of Fish and Game.

Walsh, J. E., R. L. Thoman, U. S. Bhatt, P. A. Bieniek, B. Brettschneider, M. Brubaker, S. Danielson, R. Lader, F. Fetterer, K. Holderied, K. Iken, A. Mahoney, M. McCammon, and J. Partain. 2018. The

high latitude heat wave of 2016 and its impacts on Alaska. Bulletin of the American Meteorological Society 99:S39–S43.

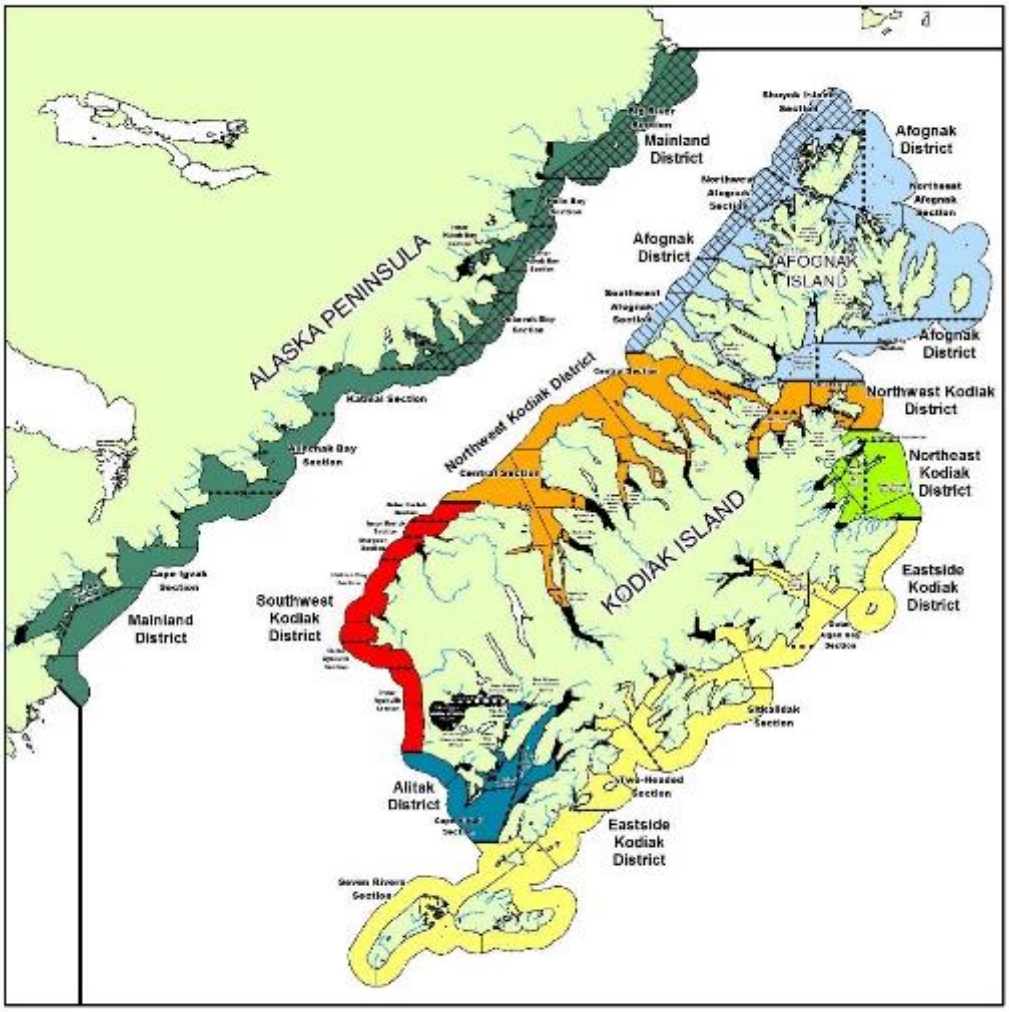
Wolkovich, E. M., B. I. Cook, K. K. McLauchlan, and T. J. Davies. 2014. Temporal ecology in the Anthropocene. Ecology Letters 17:1365–1379.

Zuur, A. F., R. J. Fryer, I. T. Jolliffe, R. Dekker, and J. J. Beukema. 2003. Estimating common trends in multivariate time series using dynamic factor analysis. Environmetrics 14:665–685.

Appendix A – Author's Biographical Statement

Dr. Michael Litzow is a fisheries oceanographer who studies the impacts of climate variability and climate change on commercially important fish stocks in Alaska. He obtained his B.S. in Biological Sciences from the University of Alaska, Fairbanks, his M.S. in Marine Science from the University of California, Santa Cruz, and his Ph.D. in Ocean Sciences from the University of Tasmania, Australia. Dr. Litzow's recent research has focused on the effects of changing ocean climate on Gulf of Alaska salmon stocks. His previous research has involved a variety of taxa, including groundfish, crabs, shrimp, herring, other forage fish, and seabirds, and he is the author of thirty peer-reviewed papers. Dr. Litzow is the owner of Blue World Research, a private consulting firm, and until recently was a research faculty member at the University of Alaska, College of Fisheries and Ocean Sciences.

December 2019



Synthesis of Chinook Salmon Stock Contribution Estimates within the Kodiak Management Area **Commercial Salmon Fisheries (Proposals 63 & 37)**

Kodiak Salmon Work Group

EXECUTIVE SUMMARY

- During all years and sampling periods regardless of the commercial salmon fishery district sampled, British Columbia (hatchery stocks) Chinook salmon dominated the

stock composition of the harvest. Estimates of contribution ranged from a low of 30% to a high of 70% with respective harvests of several hundred to several thousand fish.

- Consistently, contributions from Washington and Oregon Chinook stocks (Western US stocks) to the KMA commercial harvest ranged from 7.3% to 37% and averaged 28%.

- Contributions from Southeast Alaska/North Gulf Coast were in most cases higher than the combined contributions from both Kodiak and Cook Inlet. The estimates generally seemed to be reflective of periods of higher (1997-1999) and lower abundance (2014-2016) for Southeast Alaska stocks.

- The capability of any marine salmon fisheries sampling program to consistently estimate the harvest, in a timely manner, of at most several hundred fish over a commercial fishing season within the geographic scope of the Kodiak Management Area is untenable. Given the current status of both the Kodiak and Cook Inlet Chinook salmon stocks at present, the actions suggested by Proposal 37 are unwarranted.

- It should be noted that for the Cook Inlet stocks harvested within the Kodiak Management Area, a majority are hatchery fish produced for marine or in-river sport fisheries.

- The Chinook salmon stocks contributing to the Kodiak Management Area commercial fishery are similar to those contributing to most of the marine commercial and recreational fisheries from Yakutat to Adak, or coastwide.

INTRODUCTION

The Kodiak Management Area and the associated salmon fisheries has a long and storied history of sustainable fisheries management success. A foundational feature for this success is the escapement enumeration program using weirs and counting individual fish as they migrate upstream. This program has largely been in place since the early 1900s with weirs operated annually on the Karluk, Ayakulik and Frazer lake systems. Daily and cumulative escapement counts are relayed to the area management office for each system and when combined with other sources of data: harvests, aerial survey index counts (for systems without weirs), fishing effort along with additional biological data (timing, migration patterns, age composition) are all sourced into fishery management decisions and emergency orders to open or close districts, sections and subsections of fishing areas throughout the salmon fishing season. An additional vital feature of this program is the inclusion of enclosures or “traps” that allow for live sampling of the escapement, specifically for sockeye and Chinook salmon and the collection of biological attribute data (age, sex, length) which is imperative for building brood tables which in turn are employed for establishing and evaluating biological escapement goals and generating pre-season forecasts.

An additional prominent feature of the Kodiak Management Area salmon fisheries are the 7 management plans which guide management of the salmon stocks and species during the salmon

fishing season which commences in early to mid-June and extends into late September. The management planning process was largely initiated in the mid to late 1970s which was a period of extremely poor salmon production throughout the entire Kodiak Archipelago and was cause for multiple years of limited commercial fishing by all gear groups with the overall objective of rebuilding wild salmon stocks. These management plans were the result of extensive efforts by ADF&G management and research biologists, commercial fishermen, the local fish and game advisory committee and ultimately the Alaska Board of Fisheries over multiple triannual meetings (Malloy, 1988).

Description of Kodiak Chinook Salmon Fishery

The Kodiak Island area has two wild chinook salmon stocks (Karluk and Ayakulik Rivers) and one introduced run which originates in the Dog Salmon River. There have also been several hatchery produced chinook release sites permitted that promote road accessible shore/boat recreational fisheries. The commercial seine and set gillnet fisheries harvest Chinook salmon incidentally while targeting local sockeye, chum and pink salmon stocks along nearshore migration pathways. The harvests typically occur during June and July and at times the harvests can consist of immature or feeder Chinook that are traversing well established commercial fishing areas in the Westside, Southwest and Alitak Districts. The record commercial harvest of 42,000 fish in 1993 consisted of large numbers of immature/feeder kings and stimulated concern from the recreational sector within the Cook Inlet area that large numbers of the harvested fish were of Cook Inlet origin. The harvest during 1993 was almost twice the previous high estimate of 24,000 fish, which occurred in 1992. As a back drop to this concern, several chinook salmon stocks within Cook Inlet were experiencing poor production (Deshka and Early Run Kenai R.) while simultaneously there was a serge in production from stocks originating in British Columbia, Washington and Oregon which were largely of hatchery origin; a portion of these hatchery fish were marked with a coded wire tag and missing the adipose fin (Swanton, 1997). There are several hatchery stocks in Cook Inlet that were marked and could thereby serve for detecting the presence of these stocks in the Kodiak Fishery. A pilot commercial catch sampling program was initiated in 1994 (Swanton 1997) and was followed by a focused interdivisional sampling and harvest estimation program for the years 1997-1999 (Clark and Nelson 2001). A more contemporary and comprehensive genetic stock identification (GSI) program was conducted for the years 2014-2016 and generally corroborated previous results (Shedd et al. 2016).

North American Chinook salmon Ocean Migrations

There are literally hundreds of Chinook Salmon stocks spanning the Coastline from Oregon, Washington, British Columbia and throughout Alaska from Southeast and along the Alaska Peninsula; these stocks are often referenced as far north migrating stocks, as opposed to stocks that have more localized or truncated ocean migrations. With the advent of Coded Wire Tagging (early 1970s) coupled with extensive High Seas Tagging (conducted throughout the North Pacific) and scale pattern analyses efforts conducted by the University of Washington much insight was gleaned regarding migration patterns along coastal and open ocean migration routes. Substantial increases in hatchery production of Chinook salmon in Oregon, Washington and British Columbia occurred in the early 1990s which resulted in a surge in coastwide abundance. Much of the increased hatchery production was in response to poor production from wild stocks, compensation for habitat destruction, tribal agreements, hydroelectric dam impacts or mitigation owing to wild stock endangered species act (ESA) listings.

Coastwide abundance of feeding/rearing Chinook increased markedly and harvests of Chinook increased both within Alaska's commercial and recreational coastal marine fisheries as well as bycatch of chinook in federal fisheries operating in the Gulf of Alaska. The Pacific Salmon Treaty between the United States and Canada governs harvests of these stocks throughout Southeast Alaska (Ketchikan to Yakutat) where jurisdiction between the parties ends. The harvest of these stocks throughout the remainder of the Gulf of Alaska is viewed with recognition that they originate in other states or British Columbia and harvest should be limited or constrained where appropriate. This has been the policy direction followed by both ADF&G and the Alaska Board of Fisheries certainly within the last 10-15 years and pertains to Kodiak, Kachemak Bay and Homer spring and winter recreational fisheries and both commercial and recreational fisheries prosecuted in Prince William Sound.

Data Summaries by Year

(Swanton, 1997) Caution is suggested relative to these estimates owing to low marking fractions and less than optimum temporal and spatial sampling coverage**.**

1994

The two Kodiak commercial fishing areas where CWT sampling occurred (Westside and Alitak Districts) experienced a commercial harvest of 5,089 Chinook salmon (80% CI 2,927-7,253 fish) from marked cohorts which represented 32.5% of the sampled harvest. The stock groupings represented by the tag recoveries were: 9.7% Southeast Alaska; 83% from British Columbia; 4.9% from Washington state and 2.4% from Oregon.

From the Westside Kodiak area most of the marked cohorts were of British Columbia origin with marked fish from Southeast Alaska, Washington and Oregon also detected in lower numbers. There was an apparent temporal change in stock contribution from the week of June 12-18 which were more varied, as compared to the period June 19-25 when only British Columbia and Southeast Alaska stocks were detected. The marked cohort contribution estimates for this area spanning 12 June through 30 July was 4,655 fish (80% CI 2,517-6,793 fish) from a total catch of 14,619 fish or 31.8%.

Within the Alitak Bay District all marked fish recoveries were of British Columbia origin and represented 435 Chinook out of a total catch of 640 fish. This represented 68% of the catch during the period off sampling.

(Clark and Nelson 2001)

1997

During the 1997 Kodiak commercial salmon fishing season there were 18,728 Chinook salmon harvested with 89% of the harvest occurring during the CWT sampling period of 9 June-8 August; a majority 67% of this harvest (about 11,000 fish) took place within the Westside area. The study plan designated a sampling fraction of inspecting 20% of the observed catch for CWT's which is consistent with Coastwide sampling programs sanctioned by the Pacific Salmon Commission.

The number of Chinook salmon inspected for a missing adipose fin in1997 was 6,015 or 36% of the harvest during the sampling period; 37% of the harvest was inspected within the Westside District catch; 60% within the Alitak Bay District; sampling within the Eastside District exceeded 20% and an additional 24% (792 fish) were inspected from harvests within the Mainland fishing District.

The general stock composition from the sampled harvest was: 13% from Alaska stocks, 72% from British Columbia, 7% from Washington and 8% from Oregon Chinook stocks. The 18 tag recoveries from Alaska stocks was further broken down to include 11 recoveries from Cook Inlet: two Kenai River, three Ship Creek, three Ninilchik River, one from Deception Cr., one from Crooked R. and one from Homer Spit.

1998

In 1998 there were 17,341 Chinook harvested commercially during the sampling period 9 June-8 August with approximately 93% occurring within the Westside (including the Southwest Afognak Section and Northwest Kodiak District), Alitak Bay and Eastside Kodiak Districts. There was 53% of this harvest sampled: 45% in the Westside District, 50% in the Alitak District and 43% within the Eastside District. No samples were collected from the Mainland District as the overall catch was 393 fish.

The identified tagged fish were represented as follows: 31% (79) were Alaska stocks; 49% (125) were from British Columbia; 15% from Washington and 5% from Oregon. The Alaskan stocks originating in Cook Inlet (46 tag recoveries) were three from Resurrection Bay; 5 from Seldovia Harbor; 10 from Homer Spit; 5 from Halibut Cove; 6 from Ninilchik R., 13 from Deception Cr., one from Crooked Cr. and two from the Kenai R. The additional Alaskan stock recoveries were 9 from Southeast Alaska and 24 from the Buskin River.

1999

During the 1999 commercial salmon fishery there were 18,299 Chinook harvested which represented 94% of the harvest that occurred during the June 9-August 8 sampling time frame. About three quarters (73%) of the harvest was realized within the aforementioned fishing areas, and similar to previous years, a majority of the harvest was realized within the Westside Kodiak District. There was 46% of the harvest (7,940 fish) inspected for CWT via a missing adipose fin. Similar to the previous years 45% of the catch was from the Westside District, 41% of the Alitak Bay District. No sampling results were reported for the Eastside District, however 12% of the Mainland District (356 fish) harvest was opportunistically sampled.

There were 201 tag recoveries from the 1999 sampling effort, 124 were from the Westside Kodiak District, 10 from the Mainland District, 20 from the Eastside and three from the Alitak Bay District. There were 32% (64 tagged fish recovered) from Alaska stocks, 31% from British Columbia, 13% from Washington and 24% that originated from Oregon. There were 21 tagged fish recovered that originated from Cook Inlet stocks with distribution by area similar to 1998. The authors after consulting with fishery management staff, suggested that if any non-local stock or stock grouping was estimated to have a 10-15% exploitation rate (harvest rate applied over the entire brood year) imposed by fisheries within the Kodiak Management Area that this would be cause for concern. In addressing this, Clark and Nelson (2001) stated " Therefore, publication of imprecise, but consistently small harvests of Cook Inlet hatchery cohorts in the KMA fishery provided the best indication of the lack of importance of the KMA fishery in influencing production of chinook salmon bound for Cook Inlet."

(Shedd et al. 2016)

This study employed genetic stock identification techniques to generate stock contribution estimates for chinook salmon harvested within both the commercial and recreational fisheries throughout the Westward Region (Kodiak, Chignik and the Alaska Peninsula Management areas). The information summarized below is only for the commercial fishery within the Kodiak

Management Area to maintain consistency in comparing other information presented within this summary. This study focused on 4 Districts/reporting areas and two temporal strata (Early: 1 June-5 July; Late: 6 July-5 August).

2014

Overall, there were 8,382 fish commercially harvested of which 3,050 fish were sampled (sampling fraction of 36.4%) for all areas and time strata. The results of GSI for the entire time and area strata were: 55.6% British Columbia, 34% West Coast US (Washington and Oregon stocks combined), 3.4% Southeast Alaska and Northeast Gulf of Alaska stocks(Southeast Alaska/Gulf Coast, 2.6% Cook Inlet, 1.9% Kodiak and 1.6% referred to as the Eastern Bering Sea stock grouping. The following are the aggregate stock composition estimates broken down by geographical and temporal strata:

Northwest Kodiak District and Afognak(Statistical Areas: 251, 253 and 254)

- Early (1 June-July 5) 72.1% British Columbia stocks, 15.7% West Coast US, 4.3% Kodiak, 2.7% Cook Inlet and 2.4% Southeast Alaska/North Gulf Coast Alaska.
- Late (July 6-August 5) 56.0% British Columbia stocks, 34.7% West Coast US, 4.6% Southeast Alaska/Gulf Coast, 2.2% Cook Inlet and 1.2% Kodiak Stocks.

Eastside Kodiak and Afognak District (Statistical Areas: 258, 259 and 252)

- Early (1 June-July 5): 51.2% British Columbia Chinook stocks, 35.3% West Coast US, 4.2% Southeast Alaska/Gulf Coast, 0.3% Cook Inlet and 4.2% Kodiak stocks.
- Late (July 6- August 5):51.7% British Columbia stocks, 37.5% West Coast US, 2.6% Southeast Alaska/Gulf Coast, 4.0% Cook Inlet and 0.1% Kodiak Chinook salmon stocks.

Southwest Kodiak Alitak Districts (Statistical Areas: 255, 256 and 257)

- Early (June 1-July 5): 51.2% British Columbia stocks, 30.8% West Coast US, 6.1% Southeast Alaska and Gulf Coast, 1.1 % Cook Inlet and 10.0% Kodiak Stocks.
- Late (July 6-August 5): 54.5% British Columbia, 39.0% West Coast US, 2.9% Southeast Alaska/Gulf Coast, 1.4% Cook Inlet and 1.0% Kodiak stocks.

Mainland District (Statistical Area 262) There was no sampling conducted for the "Early" strata during 2014.

- Late: July 6-August 5): 51.2% British Columbia Stocks, 39.5% West Coast US stocks, 4.8% Southeast Alaska/Gulf Coast, 1.5% Cook Inlet and 0.9% Kodiak stocks.

2015

During 2015 the Chinook harvest was 8,087 of which 2,775 fish were sampled resulting in a 34% sampling fraction. The estimated stock contributions for this commercial fishing season were: 51.6% British Columbia, 33.9% West Coast US, 4.9% Southeast Alaska/Gulf Coast, 4.5% Cook Inlet and 4.5% Kodiak.

Northwest Kodiak District and Afognak(Statistical Areas: 251, 253 and 254)

- Early (June 1-July 5): 54.8% British Columbia, 24.3% West Coast US, 8.5% Southeast Alaska/Gulf Coast, 6.4% Cook Inlet and 4.5% Kodiak.
- Late (July 6-August 5):52.1% British Columbia, 34.9% West Coast US, 4.9% Southeast Alaska and Gulf Coast, 4.3% Cook Inlet and 3.2% Kodiak.

Eastside Kodiak and Afognak District (Statistical Areas: 258, 259 and 252)

- Early (June 1-July 5):36.4% British Columbia stocks, 46.8 West Coast US stocks, 4.8% Southeast Alaska and Gulf Coast stocks, 7.8% Cook Inlet and 3.1% Kodiak Chinook Stocks.
- Late (July 6-August 5):49.4% British Columbia stocks, 40.7 West Coast US stocks, 3.5% Southeast Alaska and Gulf Coast, 1.3% Cook Inlet and 4.3% Kodiak Chinook stocks.

Southwest Kodiak and Alitak Districts (Statistical Areas: 255, 256 and 257)

- Early (June 1- July 5): 33.8% British Columbia stocks, 35.2% West Coast US, 3.2% Southeast Alaska/Gulf Coast stocks, 2.5% Cook Inlet and 24.9% Kodiak Stocks.
- Late (July 6-August 5):63.1% British Columbia stocks, 30.3% West Coast US, 3.4% Southeast Alaska and Gulf Coast stocks, 1.4% Cook Inlet and 1.2% Kodiak Chinook stock contributions.

Mainland District (Statistical Area 262) Similar to 2014, there was no sampling conducted during 2015 within the period June 1- July 5 for this district.

- Late (July 6-August 5): 64% British Columbia stocks, 19.6% West Coast US, 3.0% Southeast Alaska/Gulf Coast, 12.8% Cook Inlet stocks and no contribution from Kodiak Chinook stocks.

2016

The harvest during 2016 was only 7,471 Chinook of which 3,189 fish were sampled, which represented a 43% sampling fraction. The various stock contributions to the commercial harvest for 2016 were: 56.5% British Columbia, 30.6% West Coast US, 6.2% Southeast Alaska/Gulf Coast, 3.8% Cook Inlet and 1.3% Kodiak stocks.

Northwest Kodiak District and Afognak (Statistical Areas: 251, 253 and 254)

- Early (June 1-July 5): 59.6% British Columbia stocks, 15.0% West Coast US, 12.7% Southeast Alaska and Gulf Coast, 7.8% Cook Inlet and 3.2% Kodiak stocks.
- Late (July 6-August 5):61.8% British Columbia stocks, 17.3% West Coast US, 11.5% Southeast Alaska and Gulf Coast, 6.7% Cook Inlet stocks and 1.6% Kodiak stocks.

Eastside Kodiak and Afognak District (Statistical Areas: 258, 259 and 252)

- Early (June 1- July 5): 57% British Columbia stocks, 27.4% West Coast US Chinook stocks, 6.4% Southeast Alaska/Gulf Coast, 2.3% Cook Inlet and 2.6% Kodiak stocks.
- Late (July 6-August 5):51.5% British Columbia Chinook stocks, 39.5% West Coast US stocks, 1.3% Southeast Alaska/Gulf Coast stocks, 3.8% Cook Inlet and 2.8% Kodiak stocks.

Southwest Kodiak and Alitak Districts (Statistical Areas: 255, 256 and 257)

- Early (June 1-July 5): 67.1% British Columbia, 24.6% West Coast US stocks, 3.1% Southeast Alaska/Gulf Coast, 1.4% Cook Inlet and 2.9% Kodiak stocks.
- Late (July 6-August 5): 69.2% British Columbia stocks, 24.7% West Coast US, 1.8% Southeast Alaska, 2.5% Cook Inlet stocks and 1.1% Kodiak Chinook stocks.

Mainland District (Statistical Area 262)

- Early (June 1-July 5): 46.6% British Columbia stocks, 44.1% West Coast US, 3.6% Southeast Alaska and Gulf Coast, 1.9% Cook Inlet and 0.3% Kodiak stocks.

- Late (July 6-August 5):54.1% British Columbia Chinook stocks, 37.1% West Coast US, 5.1% Southeast Alaska and Gulf Coast, 2.5% Cook Inlet and no contribution from Kodiak Chinook stocks to the harvest.

A direct comparison of the presented information and contribution estimates to the KMA Chinook harvest is difficult because of specific requirements related to CWT estimates and those generated using GSI. For generating reliable harvest estimates using CWT data, a large marking fraction (number of fish marked/total released) combined with a recommended 20% sampling fraction (number of fish sampled from the total catch) is statistically necessary. In the case of both the Kodiak and Cook Inlet Chinook stocks for the years 1994 and 1997-1999, the number of marked fish from the various hatchery releases was small and when combined with low numbers of recoveries, the harvest estimates were uncertain or informative at best. For these reasons, the comparisons of the CWT contributions with those generated using GSI are completed using a simple percent contribution to the overall sampled harvest (Table 1). In reviewing the data, the overall stock contributions are reasonably consistent: British Columbia stocks consistently contribute greater than 50% to the sampled harvest, followed by Washington and Oregon stocks and to a lesser extent Southeast Alaska with minor contributions from either Kodiak or Cook Inlet stocks.

Summary and Recommendations

- During all years and sampling periods regardless of the commercial salmon fishery district sampled, British Columbia Chinook salmon stocks dominated the stock composition of the harvest. Estimates of the percent contribution ranged from a low of 30% to a high of 70%, representing harvests of several hundred to several thousand fish.

- Consistently, contributions from stocks originating in Washington and Oregon (Western US stocks) to the commercial harvests ranged from a low of 7.3% to a high of 37% and averaged 28% of the estimated harvest.

- Contributions from Southeast Alaska/North Gulf Coast were in most cases higher than the combined contributions from both Kodiak and Cook Inlet. These contributions also seem to be reflective of periods of higher and lower abundance when comparing contributions from 1997-1999 (higher abundance) to those from 2014-2016 which was a period of lower Southeast Alaska stock abundance.

- The capability of any marine salmon fisheries sampling program to consistently estimate the harvest in a timely manner, of at most several hundred fish over a commercial fishing season within the geographic scope of the Kodiak Management Area, is untenable.

- Given the stock status of both the Kodiak and Cook Inlet Chinook salmon stocks a regime such as that outlined in Proposal 37 is unwarranted. Both the Kodiak (0%-4.5%) and Cook Inlet (2.6%-4.5%) stock contributions to the Chinook harvest are minor.

- It should be noted that for the Cook Inlet stocks harvested within the Kodiak Management area, a majority are hatchery fish produced for marine or in river sport fisheries. A specific brood stock selection (similar life history and migration traits to the wild stock) and marking program are required for a hatchery stock to be employed as a proxy for wild stocks, therefore the Cook Inlet tag recoveries and rates should not be applied to Cook Inlet wild Chinook salmon stocks.

References

Clark, R.A. and P.A. Nelson, 2001. Assessment of Harvests of Cook Inlet-Origin Chinook Salmon in Commercial Fisheries in the Kodiak Management Area, 1997-1999. Alaska Department of Fish and Game Regional Information Report, No. 4K01-38, Anchorage.

Malloy, L. 1988. Interception of Cook Inlet-Bound Sockeye in the 1988 Kodiak Commercial Salmon Fishery: An In-season management perspective. Alaska Department of Fish and Game Regional Information Report, Kodiak.

Shedd, K. R, K.B. Foster, M. Wattum, T. Polum, M. Witteveen, M. Stratton, T.H. Dann, H.A. Hoyt and C. Habicht. 2016. Genetic Stock Composition of the Commercial and Sport Harvest of Chinook Salmon in Westward Region, 2014-2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-11, Anchorage.

Swanton, C.O. 1997. Incidence and contribution of coded-wire tagged Chinook salmon to Kodiak Management Area Commercial Catches 9 June-6 August, 1994. Alaska Department of Fish and Game Regional Information Report No. 4K97-7, Kodiak.

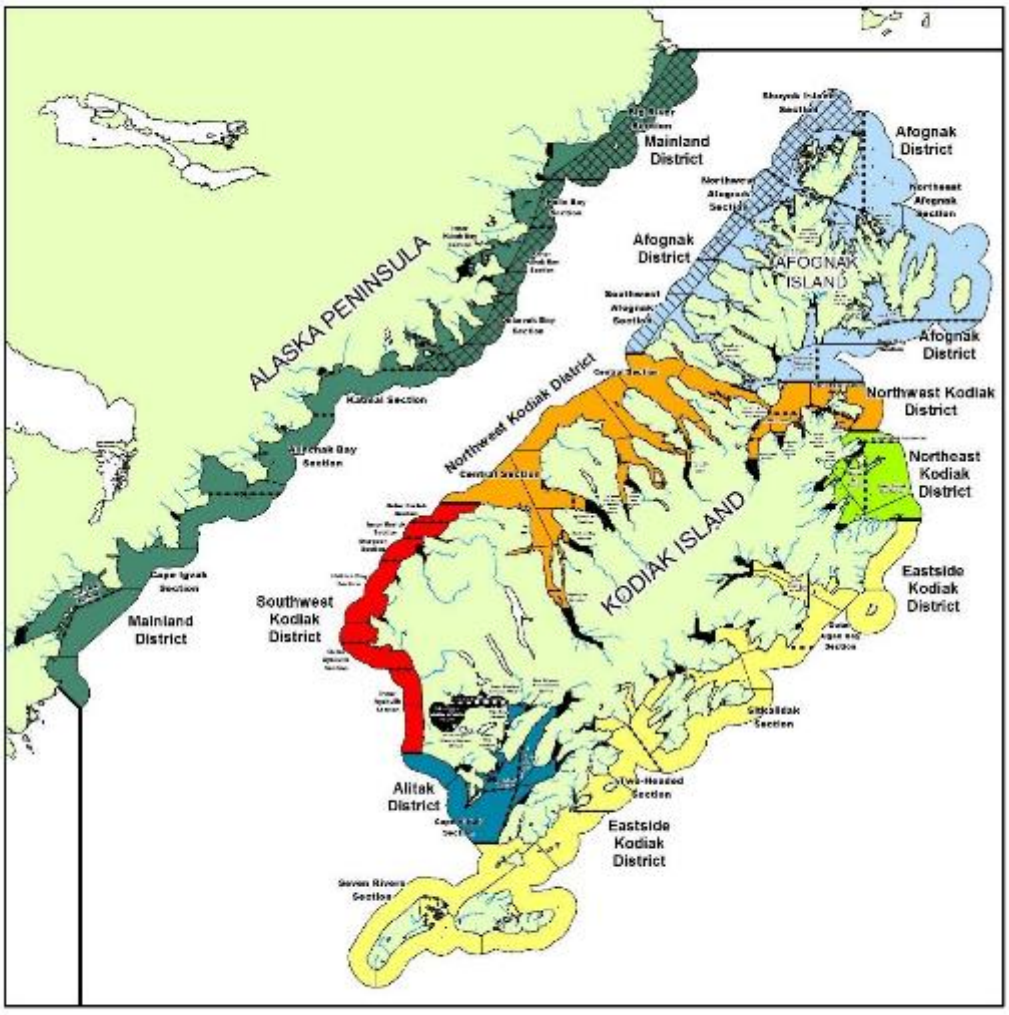
Table 1. Summary of Chinook Stock Group Harvest Percentages in the Kodiak Management Area.

	Calendar Year						
	1994	1997	1998	1999	2014	2015	2016
Sample size	5,089	6,015	9,191	7,940	3,050	2,775	3,189
Stock Group							
British Columbia	83%	72%	49%	31%	56%	52%	57%
Washington &Oregon	7%	15%	20%	37%	34%	34%	31%
SE Alaska/Gulf Coast	10%	13%	31%	32%	3%	5%	6%
Cook Inlet	0%	present[1]	present[1]	present[1]	2%	2%	4%
Kodiak	0%	n/a[2]	n/a[2]	n/a[2]	1%	1%	1%

[1] CWTs were recovered however insufficient totals to estimate a harvest proportion

[2] no CWTs recovered from fishery sampling

December 2019



An

Overview and Contrast of Management Plans and Harvests of Sockeye Salmon Destined for Upper Cook Inlet, 2014-2016.

By the Kodiak Salmon Work Group

The following is germane to addressing **Alaska Board of Fisheries Proposals 64, 65 and 66** which seek to severely curtail fishing time within traditional Kodiak Management Area (KMA) districts because of identified harvests of Upper Cook Inlet (UCI) sockeye salmon during the years 2014-2016.

EXECUTIVE SUMMARY

- The complexity within the existing UCI salmon management plans guiding management of the numerous fisheries far exceeds the quality, quantity and timeliness of the information available.

- Harvest estimates have far less uncertainty than do the variety of in season run strength projections and numerous escapement monitoring programs, especially the Susitna River escapement component.

- The Off-shore Test Fishery (OTF) run projections have errors around the estimates which are alarming (over projecting the actual run by 60%) given the reliance on this in-season tool within several prominent UCI management plans.

- Any proposed regulatory change to long established salmon fishery management plans must be able to demonstrate a measurable benefit; given poor data quality for specific UCI escapements or for certain in river run projections (Kenai R.), the information system currently in place is incapable of this task.

- When considering a system like the Susitna River, including the longstanding documented problems with estimating escapements, it is not prudent to affect adjacent management areas (e.g., Kodiak) with unnecessary changes.

- Considering the focus on coho salmon within the last three UCI board meetings (2011, 2014, 2017) and the conservative stipulations within the Northern District Management plan, if all of the sockeye incidentally caught in Kodiak were inserted into the UCI fishery mix, it would not have resulted in any benefit to Northern District coho stocks nor in-river users.

- Evaluating the commercial harvest of UCI stocks using a harvest rate metric would not be appropriate because of the uncertainty surrounding the escapement estimates of the Susitna River, Yentna River and other unassessed sockeye stocks.

Introduction

The identification and sporadic estimation of non-local stocks of sockeye salmon contributing to the sockeye harvest within the Kodiak Management Area has been completed using a variety of quantitative (scale pattern analyses and Genetic Stock Identification) and less quantitative (average weight and age proportions) techniques over the last 30 years. There does not appear to be temporal or spatial patterns or abundance-based trends of the contributing stocks, which suggests that the contributions are more random in nature (influenced more by environmental conditions: current, sea surface temperatures or broad scale climatic conditions). A common

acceptance is that fishing time in the various areas surrounding the Kodiak Archipelago targeting local stocks of sockeye, pink and chum salmon also contribute to these events. In a variety of ways one can characterize the Kodiak salmon fishery as a pass-through type fishery and the Upper Cook Inlet salmon fishery more of a gauntlet, where fish traverse through a variety of fisheries and gear types before reaching their natal streams or rivers.

Kodiak Fisheries Management plans

Area description

The Kodiak management area (KMA) includes all inland and marine waters (inside of 3 miles) south of Cape Douglas to Kilokak Rocks on the Alaska Peninsula and includes all islands within the Kodiak Archipelago. Within the area are 7 districts and 52 sections along with numerous subsections and terminal closed water areas. There are approximately 800 streams identified that have supported salmon spawning or rearing (Anadromous Waters Catalog), of which about 440 streams have been referenced as supporting measurable salmon production on an annual or biannual basis. Of the 440 systems, all support pink salmon, about 150 support chum salmon, 39 support sockeye salmon and about 175 support coho salmon populations (Clark et al. 2000). There are 593 Commercial Fisheries Entry Commission (CFEC) limited entry permits issued for the Kodiak area: 375 purse seine; 188 set gillnet; and 30 beach seine. Activity for each gear type fluctuates by year, with participation statistics for 2019 including 176 purse seine, 3 beach seine, and 148 set net permits having made at least one landing during the season.

Fishery Description

The Kodiak salmon fishery can be best described as a pass-through fishery, similar to Southeast Alaska fisheries. Pass through fisheries allow fish to reach terminal areas on their way to natal streams, where any type of fishery conducted is called a terminal fishery. Gear types participating in a pass-through fishery include set gillnet (fixed gear) and purse seine (mobile), which capture fish along their nearshore migration routes. Over time, and with the vigilance of salmon area management staff, fishing patterns, harvest magnitudes, and timing can be qualified and quantified with the goal of building information relative to run strength and migration timing by species and in many cases by specific stocks that contribute to the catch. The overall key to success of this salmon fishery management system is having specific, fixed geographic reference points, long standing accurate catch or harvest accounting, and an escapement enumeration and monitoring program for the major sockeye salmon producing systems that is conducted annually.

Management Plans

There are currently 10 salmon fishery management plans codified in regulation which prescribe how salmon fishing in each of the various districts, patterned after salmon species timing and historical fishing patterns, will be accorded. Two plans, including the Cape Igvak salmon management plan (effective prior to 1985; 5 AAC 18.360; Chignik Bound Sockeye) and the North Shelikof Strait Sockeye salmon management plan (effective 1990; 5 AAC 18.363: Upper Cook Inlet bound Sockeye), are tailored around sockeye salmon stocks destined for adjacent management areas (Chignik and Cook Inlet). The North Shelikof Strait plan was codified in 1990 following an out of cycle board of fisheries meeting that was specifically scheduled to address the unusual harvest of Cook Inlet Bound sockeye that occurred during 1988.

The remaining plans (Alitak District, Westside District, Eastside Afognak, Eastside, North Afognak/Shuyak Island and Mainland District) have been and are tailored towards meeting escapement objectives for each species using run timing and historical commercial fishing patterns, gear and areas. Other management tools include the use of subsections and a variety of

closed water areas around spawning streams (expanded or contracted) based on harvest numbers, aerial survey indices of abundance, and observed build ups of pre-spawning fish in marine staging areas. A multitude of fishery dependent and independent information is typically integrated into the inseason fishery management decision making process and in some cases these are daily decisions. As noted elsewhere, many of these management plans or the management philosophy contained within has been in existence since the late 1970s, and were systematically codified after numerous discussions within ADF&G and with commercial fishermen, processors, advisory committees, and finally with the Alaska Board of Fisheries during regularly scheduled meetings.

Upper Cook Inlet Fisheries Management Plans

Area Description

The Upper Cook Inlet (UCI) commercial salmon fishery management area comprises inland and marine waters of Cook Inlet north of Anchor Point Light. The area includes two districts (Central and Northern) with the Central District being 75 miles in length, 32 miles in width and divided into 6 subdistricts. The contemporary commercial fishing gear types allowed within the UCI are drift and set gillnet. There are approximately 1,300 commercial fishery entry permits within the UCI area, of which 570 are drift gillnet. Depending on a number of factors, the number of drift permit holders making landings in any given year ranges from 396-539 permits, which includes secondary permit holders operating in dual permit fishing operations (Farrington 2014). There are about 745 set gillnet permits issued for the area with about 500 permits making landings within any given year. Approximately 40-60 set gillnet permit holders are active within the Northern District set gillnet fishery.

Salmon fisheries management plans

There are 17 different plans that cover salmon fishing activities either directly or indirectly within the Upper Cook Inlet management area. Of the 17 plans, one deals with invasive northern pike within the Kenai R., two deal with riparian habitat protections; several govern subsistence (state or federal) fishing activities, and one that is novel to Cook Inlet: the personal use fishery management plan which is germane to fishing for sockeye salmon primarily on the Kenai and Kasilof Rivers. Graphical depictions of these complex and interdependent management plans are described during the 2008, 2011, 2014 and 2017 Alaska Board of Fisheries meetings, and can be found at the Board Support section of the ADF&G web page under the Board of Fisheries heading: www.adfg.alaska.gov/index.cfm?adfg=fisheriesboard.meetinginfo

Fishing Periods

In the Northern and Central Districts set gillnet fishery, two weekly 12 hour fishing periods are permitted on Mondays and Thursdays; in the drift gillnet fishery salmon may be taken within two weekly 12 hour fishing periods also on Mondays and Thursdays.

Central District Drift Gillnet Fishery Management Plan (5 AAC 21.353)

The stated purpose of this plan is to ensure adequate escapement into the Northern District drainages and offer management guidance to the department. The Board of Fisheries directs management of the drift fleet to minimize harvest of Northern District and Kenai River coho salmon, to provide sport and guided sport fishermen a reasonable opportunity to harvest these salmon stocks over the entire run, as measured by the frequency of in-river restrictions. In order to accomplish this task, from July 9-15 during the first and second regular fishing periods, drift fishing is restricted to the Expanded Kenai and Expanded Kasilof sections of the Upper Subdistrict and Drift Gillnet area 1. At run strengths greater than 2.3 million sockeye salmon to

the Kenai River, the commissioner may by emergency order open one additional 12 hour fishing period within the Expanded Kenai and Expanded Kasilof Sections of the Upper Subdistrict and Drift Gillnet Area 1; additional fishing time is only allowed in the Expanded Kenai and Expanded Kasilof Subsections of the Upper Subdistrict. From July 16-31 at Kenai River sockeye run strengths of less than 2.3 million, fishing during all regularly scheduled fishing periods will be restricted to the Expanded Kenai and Expanded Kasilof Sections of the Upper Subdistrict; at run strengths of 2.3-4.6 million sockeye salmon to the Kenai River, fishing during one regular 12 hr. fishing period will be restricted to one or more of the following sections or areas:… At run strengths greater than 4.6 million sockeye salmon to the Kenai River, one regular 12 hour fishing period per week will be restricted to the Expanded Kenai, Kasilof and Anchor Point Sections. From August 1-15, there are no mandatory area restrictions to the regular fishing periods with several caveats related to coho salmon destined for the Kenai River (see 5 AAC 21.353; p.347).

Northern District Salmon Management Plan (5 AAC 21.358)

The purpose of the Northern District Salmon management plan is to minimize harvests of coho salmon bound for the Norther District of UCI and to provide the department direction for management of salmon stocks. The department shall manage the chum, pink and sockeye salmon stocks primarily for commercial uses, to provide commercial fishermen with an economic yield from the harvest of these salmon resources based on abundance. The department shall also manage the chum, pink and sockeye salmon stocks to minimize the harvest of Northern District coho salmon, to provide sport and guided sport fishermen a reasonable opportunity to harvest these salmon resources over the entire run, as measured by the frequency of inriver restrictions. The department shall manage the Northern District commercial salmon fisheries based on the abundance of sockeye salmon counted through the weirs on Larson, Chelatna, and Judd Lakes or other salmon abundance indices as the department deems appropriate.

Kenai River Late-Run Sockeye Salmon Management Plan (5 AAC 21.360)

The department shall manage the Kenai River late-run sockeye stocks primarily for commercial uses based on abundance. The department shall also manage the commercial fisheries to minimize the harvest of Northern District coho, late-run Kenai king and coho salmon stocks to provide personal use, sport, and guided sport fishermen with a reasonable harvest opportunity.. The Kenai River late-run sockeye salmon commercial, sport and personal use fisheries shall be managed to meet an optimum escapement goal (OEG) range of 700,000-1,400,000 late-run sockeye salmon, achieve in-river goals as established by the board and measured at the Kenai River sonar counter located at river mile 19, and distribute the escapement evenly within the OEG range, in proportion to the size of the run.

Based on preseason forecasts and in-season evaluations of the total Kenai River late-run sockeye return during the fishing season, the run will be managed according to different run strength levels. At run strengths of less than 2,300,000 sockeye salmon, the department shall manage for an inriver goal range of 900,000-1,100,000 sockeye salmon past the sonar counter at river mile 19; subject to provisions of other management plans, the Upper Subdistrict set gillnet fishery will fish regular weekly fishing periods as specified in 5 AAC 21.320, through July 20, unless the department determines that the minimum in-river goal will not be met, at which time the fishery shall be closed or restricted as necessary; the commissioner may by emergency order, allow extra fishing periods of no more than 24 hours per week or per provisions in 5 AAC 21.365;

At run strengths of 2,300,000-4,600,000 sockeye salmon, the department shall manage for an inriver goal range of 1,000,000-1,200,000 sockeye salmon past the sonar counter at river mile 19; subject to provisions of other management plans, the Upper Subdistrict set gillnet fishery will

fish regular weekly fishing periods as specified in 5 AAC 21.320 through July 20, until the department makes a determination of run strength, whichever occurs first.
At run strengths greater than 4,600,000 sockeye salmon, the department shall manage for an inriver goal range of 1,100,000-1,350,000 sockeye salmon past the sonar counter at river mile 19; subject to provisions of other management plans, the Upper Subdistrict set gillnet fishery will fish regular weekly periods as specified in 5 AAC 21.320 through July 20, or until the department makes a determination of run strength, whichever comes first; if the department determines that the minimum in-river goal will not be met, the fishery shall be closed or restricted as necessary; the commissioner may, by emergency order, allow extra fishing periods of no more than 84 hours per week, except as provided in 5 AAC.21.365; and the Upper Subdistrict set gillnet fishery will be closed for one continuous 36-hour period per week, beginning between 7:00 p.m. Thursday and 7:00 a.m. Friday. The remaining elements of the plan relate to the inriver personal use and sport fishery.

Kasilof River Salmon Management Plan (5 AAC 21.365)

The bulk of this plan deals specifically with guidance on managing the commercial fishery for meeting the escapement goal as specified within the plan, however there are several sections that intersect with the Kenai River sockeye salmon: after July 15, if the department determines that the Kenai River late-run sockeye salmon run strength is projected to be less than 2,300,000 fish and the 390,000 optimal escapement goal for the Kasilof River sockeye salmon may be exceeded, the commissioner may, by emergency order, open fishing for an additional 24 hours per week in the Kasilof Section within one-half mile of shore and as specified in 5 AAC 21.360(c).

Additional Commercial Fishery Management Plans: *Cook Inlet Pink Salmon Management Plan (5 AAC 21.354); Kenai River Late-Run King Salmon Management Plan (5 AAC 21.359);Upper Cook Inlet Salmon Management Plan (5 AAC 21.363); Northern District King Salmon Management Plan (5 AAC 21.366).*

Sport Fishery Management Plans: *Russian River Sockeye Salmon Management Plan (5 AAC 57.150)***;** *Kenai River and Kasilof River Early-run King Salmon Management Plan (5 AAC 57.160);Kenai River Coho Salmon Management Plan (5 AAC 57.170); and the Upper Cook Inlet Personal Use Salmon Fishery Management Plan (5 AAC 77.540).*

Fishery Management Complexity

When comparing a number of fishery related metrics, complexity can be characterized by geographic scope, species richness, multiple overlapping objectives, and numbers of users/gear types/permits (human participation) which overlap a large geographic area, and in Cook Inlet, where most of the area is road or boat accessible and fishing occurs in either freshwater or marine waters. It could also be characterized by the number of regulatory proposals submitted to the Board of Fisheries' three-year regulatory cycle and emergency orders issued by the department each year. Determining a measure that captures allocative related issues such as regulatory proposals or agenda change requests (ACRs) is difficult, but there are many allocative elements interwoven within the Upper Cook Inlet fisheries and imbedded within the various salmon management plans.

Personal Use Fishery

Subsistence and personal use fisheries have undergone substantial changes within the Cook Inlet area over the last 20 plus years. There are four personal use fisheries that target primarily

sockeye salmon and collectively make up the bulk of the regulations embedded within the Personal Use management plan. The two major personal use fisheries operate adjacent to the Kasilof River, and adjacent to and within the lower portion of the Kenai River. Regarding the Kenai, retention of Chinook or king salmon has been prohibited for a number of years, owing to low production and concerns for meeting escapement goals. These two fisheries collectively are the largest participation fishery in Alaska. Over the last five years over 30,000 household permits have been issued and in several years the number of permits issued exceeds 35,000. During the years 2013-2015, average participation has been 27,850 household permits fished with an average sockeye salmon harvest of 494,115 per year (Dunker, 2018); the harvests of Kenai R. personal use sockeye salmon in 2014 and 2015 were 506,047 and 521,985 fish respectively. In 2016 the personal use fishery harvest was 264,900 sockeye salmon.

Kenai River Sport/Recreational Fishery

This fishery is arguably the largest sport/recreational fishery in Alaska with participation statistics, measured in angler days, ranging from 365,000-485,000 days annually. Sport fishing effort is spread throughout the drainage; however, a majority of the effort is concentrated below the Soldotna Bridge to tidewater. The annual recreational harvest of sockeye salmon occurs both above the sonar counting station at river mile 19 and below with an average of 20% of the harvest occurring below the counting station. The average (2011-2015) annual harvest of sockeye salmon is 422,480, of which 86,920 fish are harvested below the escapement enumeration or sonar site. The 2014 sockeye salmon harvest was 380,055 and for 2015 it was 392,116 fish (Begich et al. 2017). The recreational harvest for 2016 was 342,446 sockeye salmon.

When combined (personal use and in-river sport), the harvests have averaged 688,676 sockeye salmon annually (2014-2017; ADF&G personal communication). The Kenai River sockeye salmon escapement over these years has ranged from 1,400,047 in 2015 to 1,073,290 fish in 2017 and averaged 1,203,125 fish (Table 1.)

Fishery Management Data Sources

Escapement monitoring

Escapement has been assessed using side-scan sonar for a lengthy time period for the Kenai and Kasilof rivers and has incorporated modern gear (Bendix to DIDSON to now ARIS technology). The counts are generated daily and employed to evaluate escapement relative to fishery management decisions. There have not been any independent verifications of either the Kenai or Kasilof sonar escapement estimates. When converting to modern technology, the Bendix and DIDSON sonar systems were determined to offer almost identical escapement passage estimates for the Kasilof River, but that the Bendix system for the Kenai system generated escapement estimates that were substantially less that the estimates generated by the DIDSON system. This was also the case for the Yentna River (Maxwell et al. 2011). This information was integrated into a conversion from BENDIX to DIDSON units for the Kenai River sockeye salmon escapement, such that historical and contemporary escapement numbers were consistent.

For the Yentna River, the use of sonar to enumerate escapement was discontinued in 2008 due to the considerable uncertainty associated with the estimates (Fair et al. 2009). The current escapement monitoring program consists of counting weirs on Chelatna and Judd lakes. Similarly, for the Sustina River, a counting weir at Larson Lake is employed as an index of the Susitna River mainstem escapement. Fair et al. (2009), as a means to estimate total drainage wide escapement for the Yentna and Susitna rivers sockeye salmon stocks, employed the relationship between weir counts and a series of mark-recapture estimates to expand the weir

counts into drainage wide estimates. The identified relationships include Larson Lake weir counts accounting for 50-54% of the drainage wide mark-recapture estimates generated for 2006-2008. For the Yentna River, the relationship between the weir counts and the mark-recapture estimates ranged from 41-44% for Chelatna and Judd lakes combined. This approach certainly seems reasonable, however there is quite a bit of uncertainty about carrying this relationship forward to estimate total escapement for these drainages, especially when accounting for differential productivity that can occur with sockeye salmon populations between adjacent years, and also employing mark-recapture estimates which have their own set of assumptions and challenges.

There are numerous sockeye producing systems within Cook Inlet that have no monitoring programs, but that production contributes to the overall harvest. Shields (2010), within the annual management report, cites that the contribution of these unmonitored systems was projected to contribute upwards of 13% (835,000 fish from a total run of 6,404,000) to the Upper Cook Inlet harvest with an unknown level of escapement.

Barclay (2017) reported that for the years 2014-2016 that the unreported harvest (catch that could not be assigned to one of the predetermined sockeye stock groupings within UCI) represented 9.5% (223,106; 2014), 5.2% (138,826 fish) for 2015 and <0.1% (15,518 fish) in 2016. These findings are not uncommon with mixed stock analyses when dealing with many stocks and in most cases for small stocks. Shedd et al. (2016) aptly discusses this routine challenge by stating "Additionally, it is necessary to recognize that even with fishery samples of 380 fish per stratum, it is challenging to estimate small proportions in a mixture". Based on these recognized analytical difficulties, and the stated uncertainties regarding escapements for several Upper Cook Inlet sockeye stocks, the most prudent way to evaluate estimates of non-local stock harvest is to compare harvest or proportions of the harvest. The harvest, whether it is commercial (fish ticket receipts), recreational (Statewide Harvest survey) or personal use (household permit record) is likely the most certain source of data that managers have available to them.

Offshore Test Fishery (OTF; 2014-2017)

One of the most important data sources for UCI in-season management, given the wide array of objectives dictated by regulations promulgated by the Alaska Board of Fisheries within the last 10 years, is the offshore test fishery (OTF) which was initiated in 1979. Many of the plans and subsequent regulation changes have requirements specifically related to inseason abundance estimates. These projections are employed to make in-season management decisions attempting to meet escapement objectives for Susitna bound sockeye stocks, and for sockeye destined for the Kenai and Kasilof rivers as well. The Kenai River late-run sockeye salmon management plan and attendant prescribed fishing times for the drift and set gillnet fisheries rely heavily on this estimate, based on a multi layered tier system.

2014

The midpoint of the 2014 sockeye salmon run at the OTF occurred on July 16 (point at which 50% of the run is projected to be past the OTF). There were two formal inseason estimates of the 2014 run size made on July 21 and 23; the 23 July analysis predicted a total run of 5.8-9.1 million sockeye salmon. The best fit total run estimate deviated from the actual run of 5.28 million fish by 72% or a difference of 3.82 million fish. The best fit Kenai river total run estimate from this analysis (5.65 million) differed from the actual total run of 3.28 million fish also by 72%, representing a difference of 1.83 million fish (Dupuis et al. 2016).

2015
The midpoint of the 2015 sockeye salmon run at the OTF occurred on July 25. A formal in-season estimate of run size was made on July 27 and predicted a total run to Upper Cook Inlet of 5.9 million sockeye salmon. The best-fit total run estimate deviated from the estimated total run of 6.30 million by 6.5% (400,000 fish). An in-season estimate was also made for the Kenai River sockeye salmon run on July 27; the analysis predicted a total run to the Kenai River ranging between 2.20-3.53 million sockeye salmon. The best-fit total run estimate of Kenai River sockeye salmon was 3.53 million which deviated from the estimated total run of 3.89 million fish by 9.3% (360,000 fish; Dupuis and Willette, 2016).
2016
The midpoint of the 2016 sockeye salmon run at the OTF occurred on July 18. An in-season estimate of the 2016 run was generated on July 25 and predicted a total run to Upper Cook Inlet (UCI) of 6.83 million sockeye salmon. The best-fit model estimate varied from the total run estimate of 5.11 million by 33.7% or 1.72 million fish. The inseason estimate for Kenai River sockeye salmon was made on July 25 with an estimate of 3.53-5.57 million fish with a post season estimate of 3.55 million sockeye. Managers employed a run estimate of 4.6 million fish, an overestimate of 29.5% (1,050,000 fish; Dupuis and Willette 2018).
2017
The midpoint of the sockeye salmon run in 2017 at the OTF was July 20; a formal estimate of the run was generated on July 24 with a prediction of 7.11 million fish. The first best-fit total run prediction was 54.2% higher than the actual total run of 3.85 million (difference of 3.26 million fish). An in-season estimate for the Kenai River sockeye run was made on July 24 resulting in an estimate of 1.6-4.3 million sockeye (actual post season estimate was: 2.89 million or 44.5% (1.29 million fish below actual), or conversely 48.7% higher than actual. Regardless of which direction the error is evaluated, it was substantial (about 1.3 million fish; Frothingham and Willette 2018).

Synthesis of information

- Using an average 2014-2016 Kenai R. commercial harvest rate (catch/catch+escapement) of 57.1%, the following would be the fate of 75,000 hypothetical sockeye that enter UCI destined for the Susitna/Yentna Rivers combined: 23,982 fish would become drift gillnet harvest, 18,843 fish would become set net harvest, 3,854 harvested fish would be assigned to an unreported stock group, 9,750 sockeye would escape to unmonitored streams, and 18,571 fish would make it to the Susitna/Yentna Rivers, of which a total of 9,000 sockeye would be potentially counted at Judd, Chelatna or Larson lake weirs. The potential benefits (escapement or harvest to UCI users) would be undetectable amidst the large total harvests and monitored escapements in Upper Cook Inlet.

- The complexity of existing UCI salmon management plans far exceeds the quality, quantity and timeliness of the information available. Management staff in the department do a surprisingly successful job managing these fisheries and meeting escapement goals and objectives given the data available and estimate uncertainty.

- Estimates of harvest have far less uncertainty than do the variety of in season run strength projections or data from the numerous escapement monitoring programs,

especially the Susitna River escapement component. Therefore, the harvest estimates for UCI bound sockeye that were incidentally taken in Kodiak should be compared to the total harvest of UCI sockeye.

- In 2014, there were an estimated 58,506 sockeye salmon harvested within the KMA of Cook Inlet origin (Kenai and Susitna stocks) from a total UCI harvest of 3,360,383 or 1.7%;
- In 2015, an estimated 438,433 Kenai and Susitna fish were harvested in the KMA versus the total harvest of 3,694,270 sockeye in the UCI or 11.8%;
- In 2016, 309,497 UCI (Kenai and Susitna stocks) sockeye were identified within the Kodiak catch compared to a total UCI sockeye harvest of 3,095,833, or 10.0%.

- The OTF run projections have errors around the estimates that are alarming (over projecting the actual run by 60%) given the reliance on this in-season tool within several prominent management plans; the Kenai R. sockeye run projection placed the run in the wrong management tier 2 out of 4 years (2014, 2016) thus allowing for increased fishing time for the drift gillnet fleet.

- Any proposed regulatory change to long established salmon fishery management plans must be numerically measurable. Given poor data quality for specific escapements or to certain in-river-runs (Kenai R.) the information system currently in place is incapable of this task, even if harvests within the KMA were twice those that are currently estimated.

- Certainly, for a system such as the Susitna River with all of its documented longstanding problems in obtaining reliable and annual escapement estimates, is it not prudent to reach out and affect an adjacent management area. Currently, in order to generate Susitna River escapement estimates, the weir count (known escapement numbers) is multiplied by a constant derived from a mark-recapture study conducted for 3 three years that is now over 10 years old. Because of this unreliable method, the Susitna and Yentna Rivers escapement estimates should be treated as informative but certainly not known.

- Given the focus on coho salmon within the last three UCI board meetings (2011,2014, 2017), and the conservative stipulations within the Northern District management plan, if all of the sockeye incidentally caught in Kodiak were inserted into the UCI fishery mix, it would not have resulted in any beneficial impact to Northern District coho stocks nor in-river users. Coho salmon run strength is based on fishery performance (commercial and in-river sport) and not demonstrable escapement estimates.

- Evaluating the commercial harvest of UCI stocks using a harvest rate metric would likely be erroneous, owing to the uncertainty surrounding the escapement estimates of

the Susitna River, Yentna River and other unassessed sockeye stocks. These stocks contribute to the harvest, but escapement to these systems is unknown or indexed, not counted.

References:

Begich, R.N., J.A. Pauluk, J.L. Cope and S.K. Simmons, 2017. 2014-2015 Annual Management Report and 2016 Sport Fisheries overview for Northern Kenai Peninsula: Fisheries under consideration by the Alaska Board of Fisheries, 2017. Alaska Department of Fish and Game, Fishery Management Report No. 17-06, Anchorage.

Barclay, A.W. 2017. Annual Genetic Stock Composition Estimates for the Upper Cook Inlet Sockeye Salmon Commercial Fishery, 2005-2016. Alaska Department of Fish and Game, Regional Information Report 5J17-05, Anchorage.

Clark, J.H., A. McGregor, D. Mecum, P. Krasnowski, and A. Carroll. 2006. The Commercial Salmon Fishery in Alaska. Alaska Department of Fish and Game, Fishery Research Bulletin, Vol.12 No.1, Juneau.

Dunker, K.J. 2018. Upper Cook Inlet Personal Use Fisheries, 2013-2015. Alaska Department of Fish and Game, Fishery Data Series No. 18-10, Anchorage.

Dupuis, A. T. M. Willette and A. Barklay, 2016. Migratory Timing and Abundance estimates of Sockeye Salmon to Upper Cook Inlet, Alaska, 2014. Alaska Department of Fish and Game, Fishery Data Series No.16-43, Anchorage.

Dupuis, A. and T.M. Willette, 2016. Migratory Timing and Abundance Estimates for Sockeye Salmon in Upper Cook Inlet, Alaska, 2015. Alaska Department of Fish and Game, Fishery Data Series No.16-53, Anchorage.

Dupuis, A. and T.M. Willette, 2018. Migratory Timing and Abundance Estimates for Sockeye Salmon in Upper Cook Inlet, Alaska, 2016. Alaska Department of Fish and Game, Fishery Data Series No.18-23, Anchorage.

Fair, L.F, T.M. Willette, and J.W. Erickson. 2009. Escapement goal review for Susitna River sockeye salmon, 2009. Alaska Department of Fish and Game, Fishery Manuscript Series No.09-01, Anchorage.

Farrington, C., K. Iverson and M. Gho, 2014. Dual-permit Fishing Operations in the Cook Inlet Salmon Drift Gillnet Fishery. Commercial Fishery Entry Commission, CFEC Report 14-6N, Juneau.

Frothingham, A. and T.M. Willette, 2018. Migratory timing and Abundance Estimates for Sockeye Salmon in Upper Cook Inlet, Alaska, 2017. Alaska Department of Fish and Game, Fishery Data Series No. 18-24, Anchorage.

Maxwell, S.L., A.V. Faulkner, L.F. Fair, and X. Zhang. 2011. A Comparison of Estimates from 2 Hydroacoustic Systems Used to Assess Sockeye Salmon Escapement in 5 Alaska Rivers. Alaska Department of Fish and Game, Fishery Manuscript Series No.11-02, Anchorage.

Shedd, K.R, T.H. Dann, H.A. Hoyt, M.B. Foster and C. Habicht, 2016. Genetic Baseline of North American Sockeye Salmon for Mixed Stock Analyses of Kodiak Management Area Commercial Fisheries, 2014-2016. Alaska Department of Fish and Game, Fishery Manuscript Series No. 16-03, Anchorage.

Shields, P. 2010. Upper Cook Inlet Commercial Fisheries Annual Management Report, 2010. Alaska Department of Fish and Game, Fishery Management Report No.10-54, Anchorage.

Kodiak Seiners Association
PO Box 8835
Kodiak, AK 99615

December 12, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: **Opposition to Proposal 65**

Dear Chairman Morisky and Board of Fish Members:

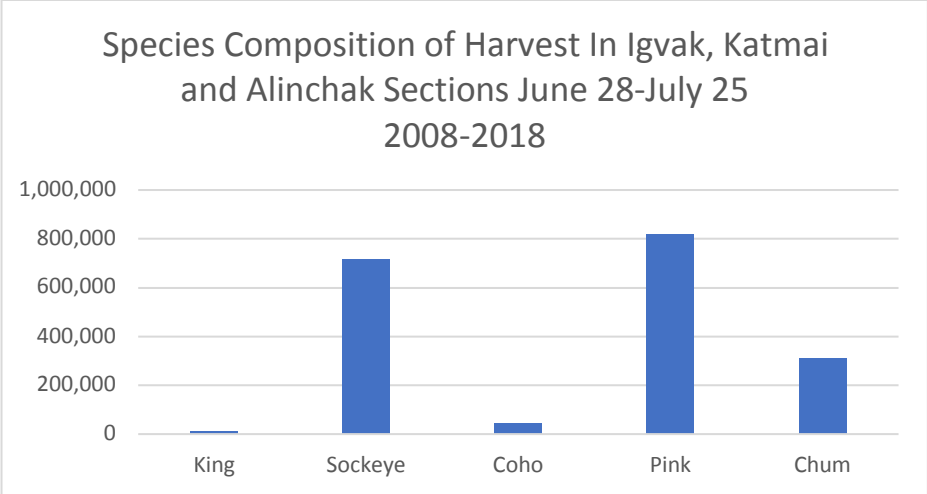
The Kodiak Seiners Association (KSA) is writing to express our **opposition to proposal 65**, which is designed to eliminate long-standing, traditional fisheries in the southern portion of mainland district of the Kodiak Management Area (KMA).

This proposal intends to eliminate a fishery that is already the most restrictively managed in the Kodiak area. While the proposal applies to the time period from June 28 to July 25th the Board should be aware that there is no fishery prosecuted in this area from June 28th until July 6th when the first of a maximum of four 57-hour openers occur in the Katmai and Alinchak bay sections of the mainland district. During this period other districts on the island are traditionally permitted 105-hour extendible fishing periods, while the mainland district cannot be extended regardless of local stock abundance. The Board should be aware that predominantly local pink and chum salmon are harvested in the area of concern for proposal 65 during the period of time that the proposal would apply.

Some of the most prolific pink and chum runs in the mainland district are located here, and the current restrictions in the management plan already provide insufficient opportunity to harvest these stocks. The chart below shows the cumulative harvest of each species in the Cape Igvak, Alinchak Bay, and Katmai bay sections[1] of the mainland district from 2008-2018. Pink and Chum salmon account for roughly 60% of fish harvested in the region during dates under consideration, while sockeye harvest only amounted to 36% of the total. During some years, harvest of pink and chum salmon, all likely of local origin, comprised up to 73% of the catch in this area. The Cape Igvak section, which is managed exclusively for Chignik bound sockeye during this period, only produced a sockeye harvest rate of 37%. Because the genetic stock analysis focused exclusively on sockeye salmon, the resulting public response to it neglected to account for the multispecies nature of our

[1] On some years fewer than 3 vessels made deliveries in some districts, so that data is confidential and not included in the tabulation.

fishery and the prevalence of pink, chum, and silver runs in the southern portions of the mainland district.



The Alaska Board of Fisheries is obligated to use the best available science to make management decisions, and KSA understands that this standard means that the genetic stock assessment of sockeye salmon harvests in the Kodiak Management Area (KMA) can be used in its analysis. Nevertheless, if the Board is going to use this study and its scientific basis then the principle conclusions of the study cannot be ignored. Among the primary findings is that the harvest of nonlocal stocks is highly variable and unpredictable, and that harvest data cannot be extrapolated temporally or geographically.

This proposal makes the mistake of projecting conclusions onto areas for which no data is available. Additionally, the proposer confusingly argues that the lack of local sockeye streams in the area means that KMA stocks of origin aren't caught here, while simultaneously and contradictorily asserting that CI stocks, which also obviously do not originate from streams in the south mainland district, are the only source of sockeye harvest in the region. The Board should be aware that no genetic data is available in this region outside of the Cape Igvak area, and that local stocks, especially late Karluk stocks, are known to migrate north up the mainland district before crossing the north Shelikof straight and heading south back down to Karluk.

The genetic stock assessment at Cape Igvak is the most limited of all areas sampled during the middle strata. There was no fishery conducted in the area in 2014, and harvests were limited in 2015 when an estimate of a mere 3560 CI sockeye taken in the Igvak section. Harvest rates in 2016 were abnormally high, and should not be considered as representative of typical fishing patterns. In fact, the contrast between harvests in 2015 and 2016 should give the Board plenty of pause before drawing any conclusions about the predictability of sockeye migration paths the KMA.

Although the harvest of CI sockeye in the Kodiak area in 2015 was by far highest of the three years covered in the genetic survey, these fish were almost entirely absent from the Cape Igvak area this year. The following year's unusual harvest of CI stocks in the Cape Igvak area demonstrates the extraordinary unpredictability of these fish. There is clearly no demonstrable harvest pattern of CI stocks, and the catch of 2016 is definitively an anomalous event that should only be taken as a

cautionary tale about the erratic uncertainty of CI sockeye migration paths. In other words, the harvest at Cape Igvak that year is indicative of what *can* happen with CI stocks at any place or any time in the KMA, and it *just so happened* to occur at Igvak that year. Igvak is already managed under strict harvest caps so that the high harvest rates immediately led to a closure of the area and thus the direct conservation of these stocks, indicating a responsibly functioning management plan that we currently have in place.

The unpredictability of salmon migrations and the need to preserve historical fishing communities while providing opportunities to harvest local stocks is the very reason why the Board long-ago adopted the Mixed Stock Fisheries Policy. It is understandable that some groups may believe that the harvest of CI fish in Kodiak is somehow unfair, however, the attempt to characterize our fishery entirely based on the CI component of our harvest is both dangerous and misguided. This proposal is asking the Board to entirely ignore the Mixed Stock Policy, discard the best available science, disregard and discount the preponderance of local stocks, and violate virtually every basic guiding principle and policy, including constitutional mandates on the utilization of fishery resources. This proposal would inflict certain and severe economic hardship on KMA fishermen, upend decades of responsible fishery management, and entirely erode confidence in the regulation of our fishery. It would do all of this simply and speculatively to provide more fish to a region that currently appears incapable of fully exploiting their local stocks.

KSA respectfully requests the Board to reject **proposal 65**. We thank you for the opportunity to comment on behalf of the membership of KSA. We appreciate the scientific and factual creation of regulations regarding our fisheries and trust that the Board continue to apply consistency in designing regulation changes while applying the guiding BOF policies, such as the Management for Mixed Stock Salmon Fisheries.

Kodiak Seiners Association represents 157 members, including the majority of actively fishing SO1K seine permit holders, Kodiak and Homer-based businesses, and individual crewmembers. Our focus is advocacy for our membership through positive interactions with ADF&G, the Board of Fisheries, and our State Legislature.

Respectfully,

Nate Rose
KSA President

December 24, 2019

Matthew Alward

60082 Clarice Way

Homer, AK 99603

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: Opposition to proposal 65

Dear Chairman Morisky and board of fisheries members,

I live in Homer, AK and operate my own Kodiak salmon seiner and I oppose proposal 65 which would close the Katimai, Alinchak, and Cape Igvak sections of the mainland from June 28th through July 25th. I raised our kids on the back deck of our seiner and they have spent some of that upbringing fishing in these sections during that time period.

This proposal is claiming that because of sockeye genetic stock data (Shedd et al ADF&G 2016) that Kodiak should be required to share in the burden of conservation of Upper Cook Inlet sockeye salmon stocks. It is also claiming that there is no "basis for Kodiak to have an UCI fishery harvest entitlement".

While there was samples taken from one tender load in the Cape Igvak section, there was none taken in the Katmai or Alinchack sections so the proposer is making assumptions for two thirds of the area that this proposal is seeking to close. This proposal also does not at all take into consideration the fact that there is quite a few local chum and pinks salmon runs in these sections during the time period that it is being asked to close. If this proposal was adopted it would force the department to over escape the local chum salmon runs creating much forgone harvest based on assumptions of UCI sockeye stocks that are not based on any data.

The claim that Kodiak needs to have part of our traditional fishery closed to "share in the burden of conservation" is false and unfounded. The Kenai and Kasilof rivers have been over escaped many of the last years and the Susitna system sockeye stocks have reached escapement goals in many of the recent years. In fact the department has recommended that the Susitna sockeye "stock of yield concern" be removed at the Upper Cook Inlet board of fisheries meeting this upcoming February. Since the major systems in UCI have been either meeting or exceeding sockeye escapement goals there is no conservation burden of the UCI sockeye stocks necessary and thus to base this large proposed closure on a sharing of burden of conservation that is nonexistent is not justification for this proposal.

This proposal also claims Kodiak has no basis for UCI sockeye harvest entitlement. The North Shelikof management plan that went into effect in 1990 is an allocative management plan with UCI that restricted the long-standing Kodiak harvest of UCI sockeye while recognizing the historical Kodiak harvest of those fish. This fact alone is evidence of Kodiak's basis for some UCI sockeye harvest entitlement.

In closing given the fact that this proposal seeks to make a large area closure based on a very limited set of data, claims that Kodiak has to share in the burden of conversation when there is no conservation burden to share, and claims that Kodiak has no basis for some UCI sockeye harvest when in fact there is over a hundred years of historical harvest, I respectively ask that you do not close a large traditional fishery and oppose proposal 65.

Sincerely,

Matthew Alward

Naomi Hall

12/27/2019 09:31 PM AKST

RE: PROPOSAL 65 Close the Katmai, Alinchak, and Cape Igvak Sections to commercial salmon fishing June 28–July 25

My name is Naomi Hall, my husband and I setnet in Uganik Bay. I am writing because I am opposed to proposal 65. Closure of the Katmai, Alinchak, and Cape Igvak Sections of the Mainland District to commercial salmon fishing from June 28-July 25 will place additional pressures on the Kodiak Area as it would consolidate the seine fleet into a smaller area. This consolidation will place pressure on the setnetters and the seine fleet as everyone vies for a piece of the pie in a smaller area. The Mainland District Salmon Management Plan was developed with the understanding that some nonlocal salmon will be harvested. Setnetters will directly feel the impact of this closure due to the stationary nature of our fishery as seiners drive around looking for new areas to fish.

Nicholas Hoffman
PO Box 1212
Kodiak, AK 99615

12/24/19

Chairman Reed Moriskey
Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

RE: Oppose Proposal 65

Dear Chairman Morisky and Board of Fish members:

I'm a young Kodiak salmon fisherman. I have been running a seine boat since 2011 as well as participating in Kodiak halibut, sea cumber, cod jig, and tanner crab fisheries. I respectfully request the Board reject Proposal 65.

This proposal is based on extremely limited data. The data is from only a few days in 2016. This was a fluke year when weather patterns pushed fish around in a huge storm. If fishing regulations are to be rewritten, the changes should be based on thorough studies using multiple years of data, not based solely on one exceptional year. Even this limited study showed nothing new, only confirmed something everyone already knows: Cook Inlet bound fish swim through Kodiak waters. According to the Constitution of the State of Alaska, Article 8, Section 3, “fish, wildlife, and waters are reserved to the people for common use.” This proposal seeks to favor one area over another demanding that Kodiak be limited in favor of Cook Inlet which is several hundred miles away. This is not a conservation issue, but simply Cook Inlet's fishermen trying to limit a neighboring fishery.

The Kodiak Management Plan is a solid mixed stock management plan that works well to balance the needs of the different species of salmon in Kodiak and already has controlled safeguards for the interception of Cook Inlet fish in the North Shelikof Strait Management Plan.

This is an allocation issue for Cook Inlet that if allowed to go forward would limit Kodiak's ability to fish our local stocks including our Igvak allocation of Chignik bound sockeye.

I see no reason for the Board to make any changes to the Kodiak Salmon Management plan. Thank you for the opportunity to comment on the proposals and the chance for my voice to be heard. I look forward to the Board of Fish members getting to spend time in Kodiak and learn more about our town and fishing community.

I humbly request the Board reject Proposal 65.

Sincerely,

Nicholas Hoffman
F/V Relentless

December 24, 2019

Alaska Board of Fisheries
Board Support Section
P.O. Box 115526
Juneau, AK 99811-5526

Re: Opposition to Proposal 65

Dear Chairman Morisky and Board of Fisheries Members,

I am Richard Roth, Kodiak salmon purse seine permit holder. Thank you for the opportunity to comment on proposals for the Kodiak finfish meeting. My wife, three children and I reside in Homer, but fish in Kodiak. I own and operate the F/V Sea Tzar. We rely solely on salmon seining for our livelihood and annual income to support our business, our family and contribute to our Alaskan economy through business and personal expenditures.

This proposal appears to be in response to an anomaly that occurred in fish migration patterns during 2016, and the proposer wants to bring up the genetic study as justification as need for change. Kodiak's North Shelikof Management Plan was created so that Kodiak fishermen would share the "conservation burden" with Cook Inlet by limiting fishing in that area so the goal of UCIDA's proposal is already addressed in current management. The genetic sockeye identification study undertaken in the Kodiak Management Area from 2014-16 really does not provide "new" information relative to the presence of Cook Inlet sockeye in the KMA, and is completely taken out of context because it only looked at sockeye rather than the full suite of salmon species that we fish for in Kodiak. This proposal would restrain fishing allowed during times of the Cape Igvak Management, which would make it difficult to reach Kodiak's traditional and historical 15% allocation which the Chignik proposals claim belong to Chignik, and Cook Inlet proposals, on the contrary, claim as their own. It would also prevent the ability to fish some areas as directed chum and early pink fisheries for Kodiak fishermen resulting in lost revenue and opportunity for our region.

Instead of an attempt to restructure the fisheries in a neighboring region, the Board's time would be better spent investigating the number of years the Kenai and Kasilof rivers have exceeded their escapement, and yet Cook Inlet drift-gillnetters and set-gillnetters still have minimal fishing time when in other regions there would be emergency openings to maintain the health of fish stocks and the rivers. For example, 2019 was a banner year, and yet commercial fishermen were forced to sit on their hands while the Kenai and Kasilof rivers were over-escaped by the hundreds of thousands.

I strongly encourage the Board to reject this proposal.

Richard, Amanda, Stephanie, Noah, and Ranger Roth
F/V Sea Tzar
Homer, AK

December 19, 2019

Robert Fellows

266 E Bayview Ave.

Homer, AK. 99603

Alaska Board of Fisheries

Board Support Section

PO Box 115526

Juneau, Ak. 99811-5526

RE: Opposition to proposal 65

Dear chairman Morisky and Board of Fisheries members,

I am a commercial fisherman who has fished salmon in the Kodiak management area for 29 years. My family depends on the Kodiak salmon fishery for most of our yearly income. This proposal would drastically affect my ability to make a living for my family and my crew. I respectfully request the Board reject proposal #65.

This proposal is in response to an anomaly that occurred in fish migration patterns in 2016 which showed up in a one-time genetic study conducted for a small time that same year. This proposal would prevent the Kodiak fish and game department from being able to manage local salmon returns at that time of year. It would prevent directed fishing for local stocks as well as the historical harvest of a small amount of Chignik bound sockeye.

The proposer references the genetic study done in the Kodiak area in part of 2016. This study only shows a harvest from a small point in time under specific weather conditions. It does not indicate a trend. It only represents a single point of data.

Sincerely,

Robert Fellows