Hello Mr. Chairman & Members of the board,

My name is Scott Daletas, a Soldotna resident, I operate a single guide outfit on both the Kasilof and the Kenai River. As a member of the Kenai/Soldotna Fish and Game advisory committee and a board member of the Kenai River Professional Guide Association, I appreciate the opportunity to share my insights on our fishery.

Today, I want to address the last two decades of Sockeye Salmon runs on the Kasilof and the Kenai River, specifically focusing on Sockeye runs that meet or exceed the current upper end escapement goals, some call it "over escapement."

When I first started, I kept hearing this term “over-escapement” usually followed by a “river collapse.” Let look back for a second.

First, I want to take us back to **1999**.
The Alaska Department of Fish and Game adopted an SEG escapement goal range of 500,000-800,000 spawners for the Kenai River late-run Sockeye salmon. From **1996** to **1999** Kenai River Sockeye Averaged 1,051,809

In **2005** the department conducted an “Escapement Goal Review for Kenai River Late-Run Sockeye Salmon.

First, The Ricker Model in **2005** Suggested the BEG should be 1.3 million. However, the department for a variety of technical reasons, labeled the Ricker model to be Suspect and agreed on the lesser Goal of 500-800,000 SEG goal. The main consensus from the department was quote “**the problems with this analysis, include the fact that no observational data is available at high levels of escapement.”**
It's interesting to me we have said the same thing back in 2005 as we did in Staff reports from **THIS** current meeting.

One last quote from the department in **2005** from the department:

“With 31 years of recruit estimates available for the Kenai stock up to 2005, no such failure has been observed, thus indicating that the observed escapements in the data set have been “small” relative to carrying capacity. When escapements are small, ability to estimate the production curve for a stock against a background of environmental “noise” is problematic because little of the curve has been exposed to observation.”

Ironically enough, the Kenai River in **2004**, **2005** and **2006** had yet again record Escapement levels ranging from 1.1 to 1.3 million Sockeye to gravel. Which their parent years in **2011** and **2012** led to nearly 1.3 million fish to gravel and a total Kenai run size of 4.5 million Sockeye!

In **2014** a commercially funded presentation here at BOF, that stated "Continued excessive escapements will lead to density dependent effects that result in poor returns and the eventual collapse of the fish stock."

Contrastingly, a whitepaper by Dr. Carl Walters examined 21 Sockeye runs in BC, posing the question "Does Over-escapement cause stock collapse." The unequivocal response was, NO.

I have attached his document below*

Moving to the present:

The Kasilof River has gone above it's goal nearly 19 times out of the last 21 years. Yet, recent data and statements from the Department on KDLL "local radio show" in **2021** indicate that we have gone significantly over the goal for three consecutive years on the Kasilof, with uncertain future yields. Again, the department was unable to answer the question in **2021**

Those years leading up to this article, referring to **2017/2018** Kasilof River Escapement have returned and it did not show signs of decline, **2023** exceeded forecasts by 24% with a total Kasilof Run Size of 1.2 million Sockeye.

This challenges the notion raised by a board member during Friday's session. "Do we need to wait and see what future returns will be?" Since 2005 we've been saying we don't have data to predict future run sizes at large escapement, however year after year our spawners increase and our Sockeye runs continue to produce.

It begs the questions, have we managed this fishery at a relatively low carrying capacity?

In my perspective, compromising the well-being of King Salmon, risking levels that may be irreparable, merely for the sake of harvesting Sockeye Salmon in the inlet seems counterproductive, especially when considering the consistent success of higher escapement levels since **2005**.

It's crucial for the board to recognize that if we were in a similar position 20 years ago, facing declining King Salmon numbers as we are currently while observing sockeye runs surpassing management goals, a decision made in 2005 to prioritize harvesting sockeye Salmon over the conservation of King Salmon would have been incorrect. Historical data indicates that our goals have consistently been influenced to be low, primarily to ensure an early commercial harvest. History has shown the Kenai River spawning habitat can carry much larger sockeye Salmon runs.

After 41 years of recruit estimates for the Kenai Sockeye stock, no failure has ever been observed, indicating that documented escapements have been 'small' relative to carrying capacity."

WILD SALMON CENTER

Over-Escapement: Is there a Problem?

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Purpose

The Wild Salmon Center has produced this White Paper in response to the concept of "over-escapement" being used as a justification for increased commercial harvest of salmon. The purpose of this paper is to examine the origin and uses of this controversial concept, and to explore the variety of perspectives on over-escapement. Is it a problem, or is it simply a natural occurrence in wild salmon ecology. An improved understanding of the perspectives and factors influencing over-escapement, will hopefully contribute to better-informed decision making in Alaska, Canada, and the Russian Far East, where "too many fish" on the spawning grounds may sometimes be considered a problem. We refer readers seeking more information on over-escapement to a recent technical paper by Canadian fisheries biologists Dr. Carl Walters et al. (2004).

Introduction

Over-escapement is an easily misunderstood term. Taken out of context, it creates confusion because it implies "too much of a good thing." When the term is used, several questions come to mind:

- Can salmon stocks be jeopardized from too many fish on the spawning grounds?
- Are we wasting fish by not harvesting them?
- How have salmon stocks survived for the thousands of years prior to industrial and commercial management?
- Do excess salmon on spawning grounds serve other important ecological functions?

These questions reflect the many perspectives that exist in the overlapping realms of salmon management and salmon ecology. In this paper, we will briefly explore some of the key perspectives relevant to this complex issue. However, as with most complex issues, finding an effective resolution to conflicting theories and perspectives is a challenge. Resolving the conflicts surrounding over-escapement is especially difficult because relevant issues may be counter-intuitive, or may be based on conflicting value sets.

We will consider over-escapement within four major contexts. They range from "economics-based" to "theory-based," so we must recognize that the different adherents are often speaking different languages, and have different value-sets. The perspectives include:

- Commercial Fisheries
- Fisheries Management
- Fish Biology
- General Ecology

(See Fig 1 – concept map of perspectives)

The core questions that bring about such varied responses from the 4 perspectives are:

1) Is over-escapement a problem?
2) If "yes," when does it occur, and why is it a problem?
3) If "no" what are the advantages of surplus spawners?

Predictably, the responses from individuals from each of the "perspective groups" fell into two categories. The harvesters and managers were practical and efficiency-oriented; the biologists and ecologists emphasized that surplus spawners serve multiple important biological and ecological functions.

Perspective	***Yes/No***	***When does it occur? OR Why is it not a problem?***
Commercial Fisheries	Yes	It occurs when the escapement goal is exceeded. Spawners in excess of the escapement goal are a lost resource, and represent lost revenue.
Fisheries Manager	Yes	It occurs when the Recruit/Spawner ratio drops below 1, indicating a negative return and non-equilibrium conditions.
Fish Biologist	No	Competition within a species promotes genetic diversity and species health.
Ecologist	No	Surplus fish feed a host of aquatic and terrestrial organisms and provide a mechanism for delivering important nutrients.

Table 1. Summary of divergent perspectives on the question: Is over-escapement a problem?

Adaptive Management
When managers try to include a broad spectrum of perspectives, they become part of the new and rapidly evolving realm of "ecosystem management." Within this realm, adaptive management is the practice of periodically adjusting management practices based on the most current scientific information. One of the founders of adaptive management, Dr. Carl Walters has recently written a technical paper entitled: Does Over-Escapement Cause Stock-Collapse? (Walters, et al., 2004). He and his co-authors have conducted a comprehensive review of the topic, and respond to the question with a definitive "No." The abstract to their paper states:

> The impact of "over-escapement," the spawning of an unusually large number of salmon from a given population or run, is examined in data from 21 British Columbia sockeye stocks and two pink salmon stocks. While there is evidence of a decrease in spawning efficiency at high spawning numbers, there is no evidence for anything like a "collapse" or "near-collapse" of production following runs with very large numbers of spawners.

The authors demonstrate, based on over 50 years of data, that the classic Ricker stock-recruitment model still holds true (see Figure 2). The Ricker model predicts declines in spawner success, as spawning numbers grow very large, due to a variety of "compensatory factors" that naturally keep large populations in check. However, misinterpretation of the model can lead to the conclusion that not harvesting surplus salmon can cause harm to the run. Applications and interpretations of the classic Ricker model are discussed in more detail below. Unfortunately, the Ricker model does not take into account the diversity of social, political and ecological factors that permeate the realm of salmon fisheries management. A series of recommendations, compiled by E. Knudsen et al. (2003) are presented at the end of this paper to guide future directions in escapement-based management.

Background

In order to reduce the confusion caused by the term over-escapement, it is useful to examine the origin of the term in the context of the 150-year evolution of fisheries management in western North America.

Salmon management has been taking place in a variety of forms for thousands of years. Historically, when intensive harvest is conducted in the absence of effective regulation, salmon stocks can collapse in just a few years. Dave Montgomery presents an historical overview of stock depletion and extinction in Great Britain and Northeastern North America in his recent book, *Salmon – King of Fish*. Montgomery explores how history repeats itself, often through a combination of over-harvest, altered and fragmented habitats, and technological hubris. History is repeating itself today in the Pacific Northwest, as many of the same mistakes are being made. As an exception, Alaskan and certain Russian Far East salmon stocks remain as some of the only fisheries that are comparable to historical levels of abundance. For this reason, we chose to examine the Alaskan fishery management experience as an example of a successfully managed salmon fishery.

A Brief Overview of Salmon Management in Alaska

Alaskan salmon stocks are healthy and abundant today, but during the very early days of salmon fishing, when there was no regulatory management, some stocks experienced near catastrophic collapse. Between the late 1850s and the early 1900s, salmon salteries and canneries sprang up all across coastal Alaska. The huge, seemingly endless runs of fish led to the development of highly efficient fishing methods that could capture nearly an entire run. Foul weather was sometimes the only factor that prevented every fish in a run from being harvested. These were the fish that "escaped" to the spawning grounds, and thus the term "escapement" came to represent the total number of fish that return and successfully spawn. When stocks showed signs of collapse, efforts were made to increase escapement to levels that would allow for sustainable harvest. In 1924, the White Act was passed by the U. S. Congress, requiring that at least 50% of an individual salmon run be allowed to return and spawn. This was the beginning of escapement-based management. Today, the Alaskan fishery is divided into 4 primary management regions, each with its own biologic and physiographic characteristics. Salmon runs in these regions are individually managed by the Commercial Fisheries Division of the Alaska Department of Fish and Game.

[Figure 3 – The four fishery management regions in the State of Alaska. (ADFG)

SIDEBAR: DEFINITION OF ESCAPEMENT, RECRUITMENT, AND SURPLUS

Escapement refers to the number of fish that return to the spawning grounds and successfully spawn. These "actual spawners" are derived from a pool of "recruits," i.e. those adult salmon who have survived the ocean phase of their life history, and have the potential to spawn. The number of recruits minus the escapement is the spawning surplus, and is the main target of commercial fisheries with the primary goal of Maximum Sustained Yield (MSY).

Escapement Based Management

Alaska has been using some form of escapement-based management since Congress passed White Act in 1924. Methods evolved in the late 1950s, when the State of Alaska gained jurisdiction over fisheries management. Today, Alaska's Department of Fish and Game conducts nearly "real-time" monitoring and regulation to assess whether salmon stocks are reaching or exceeding escapement goals. If escapement goals are not met, commercial harvest may be restricted, or even shut down.

Monitoring Escapement

The amount of effort spent monitoring escapement is enormous, and reflects the importance of the commercial fishery to the state of Alaska. Escapement monitoring is conducted by the Alaska Department of Fish and Game (ADFG), in cooperation with other State, Federal and Tribal agencies. During the spawning season, ADFG et al. use a variety of methods to keep track how many fish are returning to individual streams to spawn. Fish counting techniques include sonar counters, aerial surveys, counting towers, fish traps, counting weirs, and spawner surveys. They keep track of the actual escapement on a number of index streams, and use this information to guide the timing and duration of commercial salmon fishing efforts. If escapement goals are not reached at the monitoring stations, commercial fisheries are closed. If escapement goals are exceeded, the commercial fishery is allowed longer and more frequent open fishing periods.

[see photo 1 –more photos of escapement monitoring on website: http://www.thomasbdunklin.com/gallery/escapementmonitoring]

Establishing Escapement Goals in the Context of Maximum Sustainable Yield

Escapement goals and pre-season escapement estimates are established by ADFG biologists though a combination of historical observations and population models. While some of the methods used to set escapement goals can be fairly sophisticated, they often amount to educated guesses, generally supported by harvest and escapement data. Some of the uncertainty in establishing escapement goals is a result of the inherent variability of salmon populations and the number of variables that are unknown or unpredictable.

The explicit goal of salmon management is to achieve maximum sustainable yield (MSY). The Pacific Fisheries Management Council defines MSY as:

> **An estimate of the largest average annual catch or yield that can be continuously taken over a long period from a stock under prevailing ecological and environmental conditions. Since MSY is a long-term average, it need not be specified annually, but may be reassessed periodically based on the best scientific information available.**

The commercial fishing industry wants to harvest the most fish possible thereby maximizing profit, while still allowing populations to maintain themselves. The Alaska Department of Fish and Game's primary goal is to "maintain fish populations at historical levels of abundance," and MSY has been the target that theoretically allows them to reach that goal. To understand MSY, it is necessary to look at some of the founding principles of fisheries management.

Stock-recruitment models are theoretical curves that predict the number of fish that are expected to return from a given number of spawners, and are often used to set escapement goals. The most widely accepted stock-recruitment model was introduced by Canadian fisheries biologist W. E. Ricker (1954) and is known as the Ricker Curve (Fig. 2).

Figure 2. Ricker Stock-Recruitment Curve (modified from Walters et al, 2004)

The curve indicates that there are an ideal number of spawners that will produce a maximum number of recruits. This "ideal number" is used to set the "optimum escapement goal" or OEG. The dome-shaped nature of the Ricker Curve indicates that as spawner numbers exceed the crest of the dome, relatively fewer fish survive for each fish that returns to spawn. This is largely due to natural limits in available spawning and or rearing habitats. When the habitat limit, or "carrying capacity" is reached, spawning and rearing success begin to decline. This recognition of "diminishing returns" is at the core of the over-escapement debate. If fewer fish return for each additional spawner, doesn't it make sense to harvest those fish for food and profit? Economically the answer is simple, but ecologically, there are other factors that should be considered.

Maximum sustainable yield goals do not factor in the various roles that the spawning surplus plays at the broader ecosystem scale or in the socio-economic context. There are many social and economic factors that influence whether or not it makes sense to harvest the most fish possible. For example, in years of abundance, or during a glut of farmed fish, salmon prices may be so low that the cost of harvesting the fish may not be recovered. Recognition of these non-fish factors led to the development of the Optimum Sustainable Yield concept (Larkin, 1977). Unfortunately the difficulty in quantifying many of these factors prevents them from being incorporated into most applied fisheries management efforts. At the ecosystem scale, reduction in the number of surplus spawners directly affects the total amount of nutrients returned to the freshwater aquatic ecosystem, which in the long-term affects the overall health and productivity of the system.

Ecosystem-based models are being developed that provide an alternative to MSY-based management. Eric Knudsen et al. (2003) present a model that produces a Ricker Curve for pre and post-exploitation conditions.

Figure 4 – Hypothetical coho salmon population total run size before exploitation and total run and escapement after. (Knudsen et al., 2003).

They use the model to present a new paradigm for fisheries management founded on life history based production limits and nutrient feedback. The model clearly predicts that total run size is larger and more stable with exploitation rates less than 20%, as compared with typical historic exploitation rates varying from 40% to 60%.

Figure 5 – Kvichak river sockeye salmon catch, escapement and exploitation rate from 1956 to 2003, (Fair, 2003).

Under higher exploitation scenarios, salmon abundance declines and remains low. The authors offer some recommendations for taking the next steps toward developing an ecosystem approach to salmon escapement management. These recommendations are summarized at the end of this paper.

Long-Term Perspectives

The first salmonids appear in the North American fossil record over 15 million years ago (Stearley, 1992), and by 6 million years ago, salmon species similar to modern species were present in Idaho and Oregon. Based partly on this, David Montgomery (2000) estimates that the origin of the five Pacific salmon species occurred as early as 20 and as late as 6 million years ago. During this time, ice ages came and went, volcanoes erupted, and mountain ranges grew and eroded. Salmon adapted to, and evolved with these changes by developing life-history patterns that have built-in mechanisms to survive both rapid and gradual stresses. Surplus spawners, and highly variable life histories are two of these mechanisms. The five different species of Pacific Salmon spend variable amounts of time in the freshwater and marine environments, and return to spawn over a period of many months. They also utilize different parts of the freshwater aquatic system, extending from lake margins and river deltas all the way into small tributaries.

Outside of the management context, there are no escapement goals and no efforts to maximize spawning efficiency. Over-escapement loses some of its negative connotation, when viewed in broader biological and ecological contexts, and over evolutionary significant time scales, such as geologic time. For example, Walters et al.(2004) note that over-escapement may lead to increased straying by spawning salmon, which would assist in the recolonization of areas with depleted runs. This may be one of the key roles that over-escapement serves in the evolution of wild salmon, especially following natural disasters such as volcanic eruptions or blockage of rivers by glaciers or landslide dams.