Findings and Results from an Optimum Numbers Study on the Kodiak Food and Bait Herring Fishery

CFEC Report Number 24-05N
September 2024

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Abstract

This document details the findings of a study conducted by the Commercial Fisheries Entry Commission (CFEC or Commission) to determine the optimum number of limited entry permits for the Kodiak herring food and bait fishery. The study traces the Kodiak herring fishery's history since the early 1900s, reviews recent regulatory developments and challenges, and assesses the current economic situation of the fishery. This optimum numbers study determines the optimum economic number of limited entry permits based upon a proposed cost structure and gross revenue generated in the fishery. It then calculates net income by subtracting costs from gross revenues for 74 hypothetical participants. The economic optimum number of limited entry permits is defined as a range of permit numbers, bound at the lower end by the number of permits for which individuals at or above the bottom quartile in net earnings can expect to make the median Kodiak household income, and at the upper end by the number of permits for which individuals at or above the top quartile can expect to make the median household income. This economic optimum number is weighed, along with the management optimum number (defined by the Alaska Department of Fish and Game), to determine the overall optimum number of limited entry permits. Based on Alaska's limited entry legislation criteria, the study recommends an optimal permit range of 1 to 15 for the industry, which currently holds 9 permits. Hypothetical scenarios in which more guideline harvest is awarded to the food and bait fishery (at the exclusion of the herring sac roe fishery) are also discussed. This research helps inform regulatory adjustments aimed at ensuring the economic sustainability and viability of the fishery.

Prepared by Reid Johnson

Acknowledgements

Special thanks to Daniel Strong and Parrish Ballard for their insights and contributions to this document.

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1.0 Introduction

1.1 Petition for an Optimum Numbers Study

On October 2, 2023, the Commercial Fisheries Entry Commission (CFEC) received a petition from two Kodiak Sac Roe herring permit holders requesting the creation of additional seine permits in the Kodiak Food and Bait herring fishery (Appendix A). The petition advanced two primary arguments for increasing the number of permits.

The first argument posits that the current allocation of limited entry permits contravenes the constitutional provisions regarding access to Alaska's commercial fish resources. The petitioners contended that since most existing seine permits are registered to the same address and vessel, and may be members of the same immediate family, this arrangement constitutes an exclusive access scenario. Article VIII Section 15 of the Alaska State Constitution prohibits the creation or authorization of exclusive rights or special privileges of fishery within the natural waters of the state, excepting that the State has the power to limit entry for the purposes of resource conservation, economic health, and development of aquaculture. CFEC, in regulating and controlling entry of participants in the commercial fisheries of the state, must follow the guidelines set forth in the Limited Entry Act. CFEC depends upon the Department of Law and established court precedent to determine questions of constitutionality.

It is pertinent to highlight that the Alaska Department of Fish and Game (ADFG) has explicitly stated that participation by more than one vessel would result in the fishery being closed due to the potential to exceed the guideline harvest level (GHL); the existing permit distribution likely emerged as a direct consequence of ADFG requirements that the GHL not be exceeded. ADFG has made it clear that the fishery will not be managed as a competitive derby due to the potential for over-harvesting[1,2]. Given these restrictions, permit registration to multiple vessels is unfeasible. Moreover, there are no legal restrictions against family members forming cooperative business arrangements, which are quite common in the United States.

The second argument presented in the petition relates to the evolving economic realities of the Kodiak sac roe markets, as well as similar shifts occurring across all sac roe markets in Alaska. Initially, the limitation of herring fisheries in the 1970s was a response to the explosive growth of the industry[3], driven primarily by high demand for sac roe. This increase in demand followed the collapse of the Japanese herring fishery in the 1950s[4], which led Japanese fishermen to seek herring in Alaskan waters in the 1960s[5]. The boom that ensued was fueled by Japan's willingness to pay premium prices for sac roe, which is considered a delicacy.

Before this boom, the herring industry had largely dwindled, with the market up to the 1950s focused on using herring in reduction plants to produce fish meal and oil. Herring harvests in Kodiak ceased in 1959 and resumed in 1964, targeting sac roe[6]. Concurrently, the harvest for food and bait also commenced but initially remained minimal.

[1] Emergency Order 4-FH-K-12-23
[2] Spalinger, 2014
[3] Ricky and Adasiak, 1977
[4] Morita, 1985
[5] Commercial Fisheries Review, 1962
[6] Burkey and Reid, 1988

These market circumstances necessitated the limitation of herring fisheries, primarily to manage the surging sac roe market where the primary value of herring was perceived in their eggs. However, the petitioners argue that this market dynamic has shifted significantly, with food and bait now representing a greater value proposition than sac roe. This shift raises questions about the constitutionality of current permit allocation and whether these changing market conditions justify a reassessment of the number of permits issued.

The petition urges CFEC to not only address the constitutional aspects of the current permit distribution but also to consider whether the increased value of food and bait relative to sac roe warrants a comprehensive study to determine the optimal number of permits. This request underscores the need for an adaptive management approach that aligns regulatory frameworks with current economic realities in the herring industry.

1.2 Report Structure

This report first offers a general overview of optimum numbers regulations in Alaska before delving into an examination of the Alaska herring fishery, with a particular focus on the Kodiak region, from the early 20th century to the present day. The initial section of the report delves into the historical context of herring in Alaska, tracing its development and the evolution of herring fisheries throughout the century. It also highlights significant changes in the herring fishery, and the factors driving these transformations.

Following the historical overview, the report focuses more specifically on the herring fishery in Kodiak. This segment explores the unique aspects of the Kodiak herring fishery, examining its growth and regulatory changes. A description of historical market trends for herring are included, providing insights into the economic forces at play. This analysis also explains why certain changes in the herring market are likely permanent, supported by data and historical precedents.

The report then transitions to discussing the current state of the modern food and bait herring fishery, outlining general facts and figures that paint a picture of the industry today. Although a detailed description of data sources is briefly provided, it is noted that these sources are typically documented in other CFEC publications and will not be extensively covered in this report.

A significant portion of the report defines a cost structure for the food and bait fishery. CFEC's investigation into the cost structure of participating in this specific fishery is discussed, including costs like fuel and maintenance, as well as indirect costs such as opportunity costs. The analysis aims to provide a holistic view, acknowledging the complexity and the numerous assumptions made due to the dynamic nature of fisheries.

Portions of this report examine what ADFG management biologists consider a reasonable number of limited entry permits for this fishery. The optimum number of limited entry permits in any fishery is not solely the number that provides reasonable returns to fishermen, but also the number of participants that can be reasonably managed by ADFG without risk to the resource.

The study introduces a modeled estimate of net earnings within the food and bait fishery. This model evaluates potential average net earnings and assesses the economic viability of the fishery, with net earnings serving as the primary metric for economic standards. The outcomes of this model will inform conclusions regarding the optimum number of permits that should be issued for the Kodiak food and bait herring fishery, ensuring both economic sustainability and environmental conservation.

A critical assumption of this model is that net earnings for a permit holder should at least match the median household income in the Kodiak Borough. This assumption is crucial for ensuring the fishery can contribute to the local community economically.

In conclusion, this report aims to provide stakeholders, including fishery managers, policymakers, and community members, with a comprehensive understanding of the historical legacy of the herring fishery, current dynamics, and cost structure. By integrating historical data, current food and bait fishery metrics, and the net earnings model, this report determines the optimum number of limited entry permits for the Kodiak food and bait fishery, balancing the three optimum number standards defined in statute.

2.0 Optimum Numbers Overview

In 1973, the Alaska legislature enacted the state's limited entry statute, establishing the Commercial Fisheries Entry Commission[7]. This quasi-judicial body is tasked with the implementation and management of both open access and limited entry permits in Alaskan fisheries. Limited entry is intended to foster the conservative and sustainable management of Alaska's fishery resources, while ensuring the economic vitality and stability of the state's commercial fishing industry by regulating the entry of participants in a manner that serves the public interest and avoids unfair discrimination.

The limited entry statute outlines a dual-phase approach to determining the number of entrants in limited entry fisheries[8]. Initially, CFEC sets a cap on the number of permits for a fishery when it determines that limitation will be beneficial for the state. The initial cap on participation is then followed by defining an optimum number of limited entry permits, which may be higher or lower than the initial cap. The number of limited entry permits initially issued in a fishery typically mirrors the maximum number of participants over the last few years prior to the decision to limit and is thus termed the maximum number. This maximum number is not intended to be permanent; it was generally thought at the time of the passing of the law that the maximum number would be later adjusted downward when an optimum number was defined. Limitation usually takes place when a fishery is distressed in some way, typically due to excess participation and therefore it is reasonable that the optimum number of permits would be lower than the number of initially issued permits.

Statutory language specific to the establishment of an optimum number of entry permits can be found in Alaska Statute 16.43.290:

> **AS 16.43.290. Optimum number of entry permits.** Following the issuance of entry permits under AS 16.43.270, the commission shall establish the optimum number of entry permits based for each fishery based upon a reasonable balance of the following general standards:
>
> (1) The number of entry permits sufficient to maintain an economically healthy fishery that will result in a reasonable average rate of economic return to the fisherman participating in that fishery, considering time fished and necessary investments in vessels and gear;

[7] AS 16.43
[8] AS 16.43.290

(2) The number of entry permits necessary to harvest the allowable commercial take of the fishery resource during all years in an orderly, efficient manner, and consistent with sound fishery management techniques;

(3) The number of entry permits sufficient to avoid serious economic hardship to those currently engaged in the fishery, considering other economic opportunities reasonably available to them.

Central to the determination of an optimum number of entry permits is the definition of an economically healthy fishery, which can be found in AS 16.43.990 (2).

> **AS 16.43.990 (2). Definitions.** "Economically healthy fishery" means a fishery that yields a sufficient rate of economic return to the fishermen participating in it to provide for among other things, the following:
>
> A. Maintenance of vessels and gear in satisfactory and safe operating condition; and
>
> B. Ability and opportunity to improve vessels, gear and fishing techniques, including, when permissible, experimentation with new vessels, new gear, and new techniques.

The exact quantifiable measurement criteria for determining optimum numbers is not defined either in statute or regulation. There is no established definition of reasonable or sufficient rate of return, or economic hardship. While the exact legislative intent is unknown in this regard, CFEC operates under the assumption that the exact criteria are undefined because every fishery is unique, and it is incumbent upon CFEC to determine what a reasonable rate of return is, or what economic hardship looks like for each fishery. Answers to these questions will differ greatly depending on which fishery is being examined. Reasonable rate of return and economic hardship will have a completely different definition for the Yukon commercial lamprey fishery than for the Kodiak state waters cod fishery, for example.

It is very apparent, however, that net earnings for any permit holder should be enough to both support themselves and make improvements in their commercial operations. In other words, commercial fishing should be a form of gainful employment.

Fisheries are by their very nature extremely economically volatile. Unlike other large-scale food producing operations, fisheries depend critically on the successful management of the interaction between harvesters and the environment. This contrasts with farming and ranching, which occur in more controlled environments where the farmer or rancher exerts significant control over the outcomes. In essence, farmers and ranchers "reap what they sow," exerting considerable effort and care throughout the season.

The essential volatility of fisheries as an industry compared to other food producing industries such as beef, pork, wheat, or rice can perhaps most succinctly be illustrated by the options available in commodities exchanges. It is possible today to buy and trade futures for wheat, pork, rice, and more. In contrast, it is not possible to buy any futures for wild caught seafood because seafood markets are too inherently unstable.

The optimum number is actually a range of numbers for which CFEC has determined the fishery can be managed efficiently, and for which gainful economic opportunity can be afforded to permit holders. This optimum range of limited entry permits may be higher, lower, or contain within it,

the maximum number of limited entry permits. If the maximum number of limited entry permits is within the optimum number range, no action needs to be taken by CFEC.

Should the determined optimal number of permits be lower than the established maximum, the Commission has the authority to initiate a permit buyback program under AS 16.43.320. This includes a dedicated plan and fund for purchasing permits within the fishery. Additionally, the Commission can enact a regulation that allows for a buyback assessment, charging up to 7% of the gross earnings from each permit holder's catch. The rules also facilitate the acquisition of transferable entry permits to reduce the number of active permits to the designated optimum. This system is designed to be equitable, allowing those who wish to exit the fishery to be compensated fairly by those choosing to remain. This ensures that if a buyback is necessary, those exiting the fishery are compensated at market value by those continuing to fish, rather than selling their permits to new entrants. If the optimal number exceeds the current number of issued permits, the commission shall distribute new permits valued at the current market rate. It is noted CFEC has never enacted a buyback program under its statutory authority.

The optimum number of permits is not necessarily permanent. Should there be significant changes in the fishery, CFEC may conduct a new optimum number study to redefine the optimal permit range.

2.1 Historical Perspective on Optimum Numbers Regulations and Legislation

Since the enactment of Alaska's limited entry law in 1973, there are notable developments in defining optimum numbers for fisheries, specifically highlighted by the initial findings for the Bristol Bay salmon drift gillnet fishery and others[9]. These fisheries were identified as suffering from compromised sustainability and economic viability, largely due to the excessive number of gear units involved in the commercial harvest.

The law mandates the Commission to label a fishery as "distressed" when it is projected that the optimal number of entry permits will fall below the peak number of gear units used in that fishery in any of the four years leading up to limitation. Such a designation must occur before setting a maximum limit and prior to the first round of permit allocations. The Bristol Bay salmon drift gillnet fishery, as an example, was categorized as "distressed" based on the legislative findings within the limited entry law, the declining numbers of sockeye salmon in Bristol Bay, and the fishery's economic struggles. This led to its status being determined before the fishery's limitation in 1973. Out of the initial 19 salmon fisheries considered, eight were officially classified as distressed through regulatory means[10].

It's important to note that while being deemed "distressed" implies an optimum number lower than the existing permits, this status does not mean that an optimum number will be set. Instead, the law specifies that the establishment of this optimum number will take place after the initial distribution of entry permits.

Upon the enactment of the limited entry law, there was an anticipation that the determination of optimum numbers, the introduction of buyback programs, and consequent reductions in the fishing fleet would occur promptly following the initial allocation of the maximum number of permits. The *1975 Annual Report* from the Commission noted that efforts to identify optimum numbers

[9] Martin, 1979
[10] 20 AAC 05.300

would be concluded by 1976, with expectations of instituting a buyback program shortly after[11]. To support this, economic analyses on operational expenses and net earnings were carried out[12]. Additionally, ADFG was tasked by CFEC to offer estimates of optimum numbers for the purpose of management, aligning with the second optimum number standard.

Progress towards setting optimum numbers began to slow. The task of issuing initial permits turned out to be more complex than anticipated, complicated by the intricate nature of certain permit applications, which necessitated hearings and an extended adjudicatory process. The Commission planned to finalize the permit allocation process before moving forward with determining optimum numbers and initiating buybacks.

Changes also started to emerge within the salmon fisheries. The adoption of the limited entry law, together with the Fisheries Management and Conservation Act of 1976[13]—which established a 200-mile exclusive fisheries zone—sparked a revival in previously declining salmon populations. Developments in salmon hatchery production further contributed to this resurgence, significantly affecting some regions. These improvements led to increased net earnings for fishermen, with permit values rising in tandem to reflect the positive changes.

This resurgence sparked new concerns within the Alaska legislature regarding the broader effects of limited entry, including the escalating costs of entering fisheries, the challenges faced by young Alaskans aspiring to enter limited entry fisheries, and the risk of permits being acquired by nonresidents. In response, in 1979, the state legislature initiated studies to examine transformations occurring under the limited entry system and to reassess alternative approaches, particularly in relation to the transfer of permits. This resulted in the establishment of the Commercial Fisheries and Agricultural Bank (CFAB)[14], a non-profit cooperative lending institution for fishing and agricultural operations.

The 1980s saw a rekindled interest in buyback programs among certain commercial fishing associations. CFEC undertook studies on operating costs and net returns in various fisheries to keep track of changes and gather essential data that could assist in forecasting the outcomes of further reductions in the fleet[15].

In May 1985, the Commission was informed through an opinion from the Alaska Attorney General that the limited entry law's provisions for a buyback program were unconstitutional, primarily due to the requirement of an unconstitutional dedicated fund[16]. This finding prompted the Commission to reassess the buyback aspect of the law and propose amendments to address the constitutional issues raised.

The situation regarding fleet reductions became even more complicated in 1988 following a decision by the Alaska Supreme Court in the case of *Johns v. CFEC, 758 P.2d 1256*, which cast doubt on the future of such initiatives. The court highlighted an inherent tension and conflict between the limited entry clause of the state constitution and the constitutional mandates ensuring open access to fisheries for all people. The court suggested that to remain constitutional, a limited entry scheme must minimally impact the open fishery provisions while adhering to the

[11] Ricky et al., 1976
[12] Baker and Muse, 1979
[13] Fisheries Management and Conservation Act 1976
[14] Commercial Fisheries and Agricultural Bank, 2010
[15] Schelle and Muse, 1984
[16] 1985 Informal Opinion Att'y Gen. (May 1985). No. 366-279-85

constitutional objectives of limited entry, which include preventing distress among fishermen and conserving resources. The court also stated that the limited entry act's optimum numbers provision serves as a critical tool in ensuring that limited entry remains aligned with its constitutional goals; without optimum numbers provisions, limited entry risks becoming a mechanism that privileges permit holders and maintains permit values at the expense of exceeding its constitutional mandates.

This ruling significantly influenced the approach to fleet reductions within Alaska's limited entry framework, emphasizing that restrictions on fishery participation must be justified either for conservation purposes or to alleviate economic hardship within the industry. The court clarified that permit value depreciation due to the issuance of more permits does not constitute economic distress for current permit holders, even if they had acquired their permits at market value. According to the Johns decision, adjustments to the optimum number of permits are essential under AS 16.43 to keep the limited entry program within constitutional bounds.

Consequently, the Johns ruling diminished the appeal of a buyback program funded by fishermen. If reductions in fleet size were to enhance a fishery's economic outcomes, there could be future legal challenges arguing that the industry has become overly exclusive, potentially mandating an increase in the number of permits to ensure compliance with constitutional requirements.

The state faced the paradoxical situation where it might have to reintroduce permits into a fishery after having previously financed a reduction in permits through taxation on fishermen. Following the Johns ruling, CFEC shifted its attention towards fisheries perceived as overly restrictive. The ruling had a direct impact on the Southeast Alaska roe herring purse seine fishery. On December 10, 1993, after a thorough investigation, the Commission determined an optimum number of 46 permits for this fishery, a regulation that was enacted in January 1994. This optimum number was higher than the initial maximum limit set for the fishery but lower than the total number of existing permits, including interim-use permits still in circulation[17].

3.0 A History of Alaska's Herring Fisheries

The commercial herring fisheries in Alaska first began as reduction fisheries in the late 1800s[18]. Using purse seiners, large amounts of herring were harvested and processed to produce fish meal and oil. In the 1800s, production of petroleum products was in its infancy. Many modern products now produced from the petrochemical industry previously had to be produced from either industrial agriculture, industrial fisheries, or whaling. Herring fisheries started in Southeast Alaska, and gradually moved north to target additional herring stocks. These initial fisheries were not prosecuted to produce human consumable food stuffs, but rather to produce oil and fish meal for use in industrial processes[19].

By the 1900s, Alaskan herring continued to be harvested and processed in reduction plants, but new markets for this herring began to develop. Processors aimed at producing herring for human consumption by salting, packing, and shipping them in barrels as scotch-cured herring. These herring packs were sent to markets along the east coast where demand for herring was high among European immigrants. Initially, there was some success as imports of Atlantic herring were reduced significantly due to the first and second world wars. However, prices were extremely volatile. At

[17] Schelle et al., 1992
[18] Mackovjak, 2022.
[19] Fineburg and Johanson, 1967

its peak, Alaskan suppliers packed more than 140,000 barrels of scotch-cured herring, over 36 million pounds, in 1922[20].

Over the next few decades, the market for herring changed significantly, culminating in the eventual decline of what was once a robust herring fishery in Alaska. Herring fisheries in the state would not recover until the sac roe fishery in the 1960s.

After World War II, with wartime restrictions ended, trade began to recover. This did not bode well for the Alaskan herring fisheries and their markets. Atlantic herring imports from Europe quickly filled east coast markets and demand for Alaska Pacific herring subsequently fell. Pacific herring was, and still is, a substitute in the minds of consumers for Atlantic herring. Alaskan herring struggled to compete due to extremely high transportation costs, as well as a new territorial tax[21]. Transportation costs continue to be a significant challenge for modern fisheries in Alaska.

In 1952, Peru expanded its territorial waters to capitalize on its immense anchovy stocks. Production of salted and barrel-packed herring eventually halted in Alaska in 1953 while Peru became known for its extremely productive sardine and anchoveta fisheries, with annual harvests in the tens of millions of metric tons[22,23]. Sardines and anchoveta are both forage fish and fill in large part the same commercial and environmental niche that herring fills. Alaskan herring are in direct competition with sardines and anchoveta in the commercial marketplace.

In the 1960's, sales of fish oil produced from Alaskan herring struggled as the market faced fierce competition from alternative fish oils, seed oils, and animal fats, which had become more readily available. In the 1800s, oils produced from fish had many industrial and non-food uses, and demand for oil controlled to some degree the price of fish oil, this effectively ceased by the 1950s.

Though economics played a significant role in the downturn of herring reduction operations, public sentiment also played a key factor. The reduction industry produced significant waste which impacted local water quality. Many salmon trollers and halibut fisherman also felt that harvesting such quantities of herring would negatively impact fish stocks that preyed on the herring[24]. The reduction industry's methods of production routinely put them at odds with those who felt that the herring should have been used for human consumption or bait, rather than treating it like an industrial product. By 1966, faced with poor economic conditions and adverse public support, large scale herring reduction operations ceased in Alaska[25].

At the same time, Japan, whose domestic herring stocks had been significantly depleted due to close to a century of overfishing, began to look internationally to meet its domestic demand for herring roe. Herring roe was and continues to be a delicacy in Japan and is commonly consumed during the Japanese New Year as a symbol of fertility. In 1963, two Japanese fishing vessels were caught fishing in the Shelikof Strait. At the time, it was not clear whether Shelikof Strait was part of Alaskan waters. Though the crew was arrested, and the vessels impounded, this incident resulted in an agreement between Japanese buyers and Alaska fishermen to directly purchase herring for

[20] Pacific Fisherman Yearbook, 1922
[21] Alaska Fish Co. v. Smith, 255 U.S. 44 (1921)
[22] Tveteras et al., 2011
[23] Laws, 1997
[24] March and Cobb, 1910
[25] Mackovjak, 2022

roe[26]. While this agreement never was enacted, it spurred the development of the sac roe fishery in Alaska in 1964, defining much of the Alaska herring fishery in the following decades.

3.1 Herring History in Kodiak

Commercial harvest of herring in Kodiak, starting in 1912, predates statehood[27]. Sales in the early years were primarily driven by markets along the east coast of the United States[28]. Herring was salted, cured in barrels, and then shipped by rail to consumers. These early years were bolstered economically through the influences of the World War I, which made it impossible for Atlantic herring to be brought to market along the eastern seaboard of the United States. However, Alaskan herring was seen as a viable substitute. In the 1930s, the focus of the herring fishery in Kodiak shifted towards using herring in reduction plants to produce fish meal and fish oil. This industry was intensive and required vast amounts of herring to process in reduction plants. Harvests of herring began to increase and eventually peaked in 1947, when a total 48,450 tons of herring were caught and processed in Kodiak[29]. However, following the end of World War II, international trade began to ramp up, and herring oil was increasingly supplanted by cheaper alternatives. Eventually reduction harvest began to decline in the 1950s.

When the state of Alaska obtained jurisdiction over its state waters fisheries in 1960[30], herring harvest in Kodiak had ceased and the fishery was effectively gone. Commercial fishing for sac roe had not yet taken off and would not begin until 1964, while the harvest of herring for reduction plants ended by 1959.

It's impossible to discuss the Kodiak food and bait herring fishery without addressing the Kodiak sac roe fishery. The first inkling of the coming boom in the Alaskan sac roe fishery began in April of 1962 when the Japanese Fishing Agency authorized a fleet of vessels to harvest herring in an exploratory manner in Shelikof Strait. This fleet consisted of one processing mothership and four catcher vessels. The Japanese Fishing Agency felt it could authorize fishing in the Shelikof Strait, considering it “international waters”. They went so far as to make a public announcement they were doing so in national and international publications. The State of Alaska law enforcement arm felt that the Shelikof Strait was part of their state waters jurisdiction. Strangely, it can be inferred that the Bureau of Commercial Fisheries did not feel that Japan was impinging upon US fishing grounds: the fishery was announced in the June 1962 Commercial Fisheries Review, a Bureau of Commercial Fisheries publication.

The Japanese vessels entered the Shelikof Strait in 1963 and began harvesting and stripping herring for sac roe, a delicacy. The vessels were impounded by Alaska law enforcement and the skippers arrested and released on bail. While the captains of the ships were released on bail, Japanese interest groups agreed to purchase seafood from Alaska. With the agreement to purchase Alaska products in place, Alaska authorities felt it unnecessary to prosecute. By the latter half of 1964 the Kodiak sac roe herring fishery began in earnest.

Similarly, the modern herring food and bait fishery began in 1964. As mentioned previously, harvest for herring occurred prior to 1963, but it was primarily destined for reduction plants which produced fish oil and fish meal. Harvest in the food and bait fishery has always been low compared

[26] Commercial Fisheries Review, June 1963
[27] Burkey and Reid, 1988
[28] Mackovjak, 2022
[29] Reid, 1971
[30] 72 Stat. 339 – *An act to provide for the admission of the State of Alaska Into the Union.*

to historical harvest in the reduction fishery. From 1964 until 2001, harvests ranged from a low of 5 tons (1975) to a high of 399 tons (1978). In some years, no harvest occurred[31,32]. As herring sac roe fishing was the more lucrative opportunity, it had several effects on the development of food and bait fishery over the next few decades.

1. The start date of the food and bait fishery would be pushed back from July until August, to avoid interfering with the harvest of sac roe. This limitation came into effect in 1974.
2. The majority of the GHL was allocated to the sac roe fishery, which at the time was the most valuable market for herring harvested in Kodiak. Prior to 1979, no GHL existed for the food and bait fishery; in 1979 and 1980, the GHL was set at 12,600 tons, which was then reduced to 1,000 tons in 1981[33].

Prior to 1977, only seiners were allowed to fish for herring in Kodiak but starting in 1977, trawl gear was permitted to harvest herring[34].

The modern food and bait fishery can be considered a shoulder or secondary fishery. Unlike primary fisheries, shoulder fisheries are supplemental to a permit holder's income, rather than the primary source. These fisheries are typically located near a permit holder's primary fishery and utilize the same infrastructure, such as vessels, housing, and logistics. Additionally, they benefit from existing personal relationships with crew and processors established in the primary fishery. The costs associated with participating in shoulder fisheries are often partially covered by expenses already incurred for the primary fishery. For instance, since participants in shoulder fisheries already own the vessels used in their primary fisheries, no additional vessel costs are incurred, although they still incur operational costs.

3.2 Limitation of the Kodiak Food and Bait Herring Fishery

In 1999, the Alaska Board of Fisheries changed the opening date of the food and bait fishery to October 1, from its usual start in August. This caused food and bait fishermen in Kodiak to petition the CFEC to examine the possibility of limitation for the food and bait fishery.

When the fishery opened in August, many professional fishermen were fishing for salmon as the season was still ongoing. The Kodiak salmon seine fishery is lucrative compared to shoulder fisheries such as the herring food and bait fishery. Salmon fishermen would not give up a portion of the salmon season to fish for herring, although they would likely be very efficient at doing so. When the opening date was moved to October, food and bait permit holders were concerned that many salmon fishermen would enter the herring fishery since it no longer coincided with salmon fisheries. These potential new entrants into the fishery had experienced crew, and efficient and capable skippers. This concern was shared by ADFG management biologists.

The food and bait fishermen were also concerned about the number of closures occurring in the food and bait fishery. As previously mentioned, this fishery had never been very productive; with low GHLs and frequent closures. These factors, combined with the possibility for new entrants into the fishery, increased the concern among the food and bait fishermen.

[31] Reid, 1971
[32] Spalinger, 2018
[33] Gretsch, 1992
[34] Mackovjak, 2022

CFEC commissioners found arguments by fishermen in favor of limitation convincing, especially given the fact that the number of consistent participants in the fishery were few. In any given year from 1989 to 1998, the average number of first year participants was over 50 percent[35].

In 2000, CFEC commissioners voted to limit the Kodiak herring food and bait fishery. The limitation process was unusual partly due to the ongoing and extremely lucrative sac roe fishery, as well as the very small but diverse number of vessels that had historically participated in the fishery.

The Kodiak food and bait herring fishery was limited as a separate fishery resource from the sac roe herring in Kodiak. This was due to a petition raised by participants in the sac roe fishery to specifically limit the sac roe fishery separately from other herring fisheries. Moreover, the Alaska Board of Fisheries (the organization responsible for defining the fisheries that CFEC is responsible for limiting) historically defined herring fisheries as the separate product categories of food and bait, sac roe, and spawn on kelp.

Another distinctive, though not unprecedented, aspect of this limitation process was the treatment of gear. When the Kodiak sac roe fishery was limited, permits were created to allow the use of gillnet gear, seine gear, or both, reflecting historical participation by both gear types. This approach was extended to the limitation of the Kodiak food and bait fishery, with the addition of trawl gear. Limited entry permits in the Kodiak food and bait fishery thus allowed for the use of a combination of seine and gillnet gear, or the use of trawl gear.

When this fishery was limited, fish capacity restrictions were written into regulation in addition to the normal gear type restrictions inherent in a CFEC fishing permit. These capacity restrictions included the categories A, B, C, and D, corresponding to vessel lengths of up to 80 feet, up to 75 feet, up to 70 feet, and up to 60 feet respectively. These vessel length restrictions resulted in a combination of 8 different limited entry permit types in combination with the trawl and seine/gillnet gear types (Table 1).

Table 1: Kodiak Herring Food and Bait Permit Types

Permit Type	Resource Type	Gear Type	Vessel Restriction	Area Restriction	Number of Limited Entry Permits Issued
H1AK	Herring Food and Bait	Seine/Gillnet	80'	Kodiak	0
H1BK	Herring Food and Bait	Seine/Gillnet	75'	Kodiak	0
H1CK	Herring Food and Bait	Seine/Gillnet	70'	Kodiak	0
H1DK	Herring Food and Bait	Seine/Gillnet	60'	Kodiak	5
H7AK	Herring Food and Bait	Trawl	80'	Kodiak	0
H7BK	Herring Food and Bait	Trawl	75'	Kodiak	1
H7CK	Herring Food and Bait	Trawl	70'	Kodiak	1
H7DK	Herring Food and Bait	Trawl	60'	Kodiak	2

Limitation had the desired effect and prevented the fishery from further expanding. Only nine permits were issued, and not every available permit type was issued. All nine permits initially issued are still renewed on a yearly basis, and none of the permits have been cancelled.

[35] Malecha, 2000

Even with limitation, ADFG was concerned about the possibility of overharvest with the number of permits CFEC issued. These concerns led to ADFG restricting participation even further, adding the stipulation that only one vessel may fish at a time to avoid overharvest of the GHL. Consequently, a fishery combine was formed, and each permit holder could either join the combine or declare non-participation[36]. Since limitation, permit holders in the Kodiak food and bait herring fishery continue to operate as a combine. In agreement with the combine conditions, profits are paid out to all permit owners. CFEC is not privy to any details regarding how earnings are distributed among permit holders, but it has been made clear to us that each permit owner gets some portion of the proceeds from the fishery.

3.3 Current Kodiak Food and Bait Herring Regulations and Management Considerations

The Kodiak food and bait herring season occurs within the Kodiak Management Area, encompassing all state waters of Kodiak Island and the state waters on the eastern coast of the Alaska Peninsula, from Kilokak Rocks to Cape Douglas (Figure 1)[37]. The season commences on September 1 and concludes on February 28[38]. The GHL for this fishery is set at 10% of the GHL for the sac roe fishery and is determined on a section-by-section basis. For instance, if the GHL for the sac roe fishery in West Afognak was 1,000 tons in 2022, the corresponding GHL for the food and bait fishery would be 100 tons[39]. The food and bait GHL is 100 tons out of the total 1100 available, or 9.1% (100/1100) of the total herring GHL available in this specific scenario.

[36] Fuerst, 2023
[37] 5 AAC 27.500
[38] 5 AAC 27.510 (b).
[39] 5 AAC 27.535 (b)

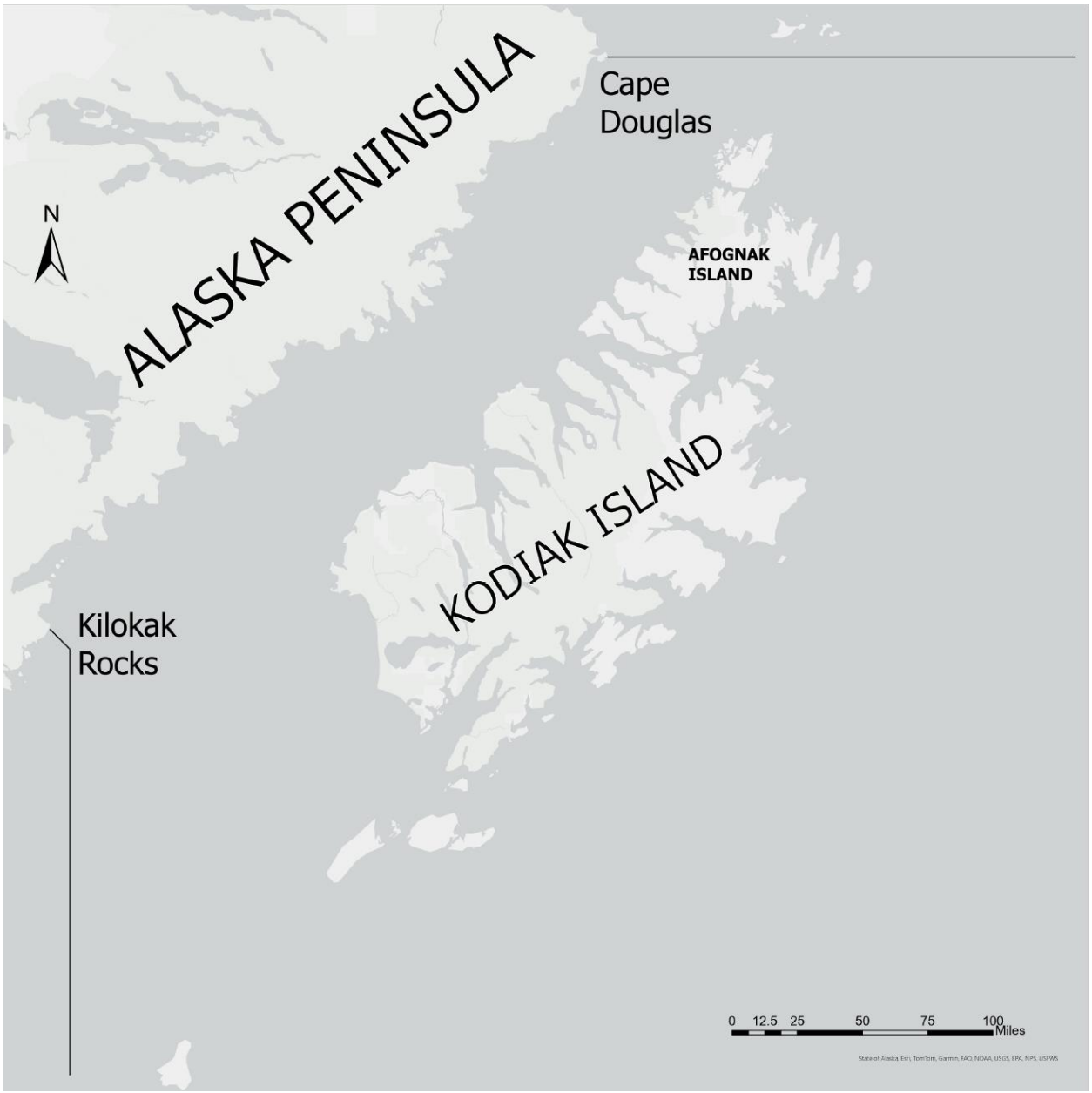

Figure 1: Kodiak Management Area

Both trawl, seine, and gillnet gear types are all allowed to participate, but due to the fishery combine, only seine gear has ever participated in this fishery since limitation.

In the 1980s, significant populations of harvestable herring were observed in the eastern Shelikof Strait, identified primarily as Cook Inlet herring spawning in Kamishak Bay. To protect these stocks, offshore sections of the Shelikof Strait are now closed during the food and bait herring season[40].

The distinction between sac roe harvests during the spawning season, and food and bait harvests during the fall are not arbitrary and have a strong basis in biological science. Herring are highly

[40] Fuerst, 2023

migratory throughout the year but are generally recognized as coming from those areas that they spawn. Herring spawning in Kodiak are recognized as Kodiak herring stock, and those from Cook Inlet are classified as Cook Inlet herring stock. The sac roe fishery, which targets local stocks just before spawning, contrasts with the food and bait season which occurs after the herring have fed throughout the Alaskan summer. This seasonal difference means herring caught during the food and bait season may not be local, necessitating a lower GHL that is only 10% of the sac roe GHL to avoid overfishing non-local stocks. Currently, ADFG does not conduct studies to determine the origin of the herring stocks.

3.4 Changing Sac Roe Markets

The markets have changed for herring over the last 30 years. The proximate cause of the petition to CFEC to conduct an optimum numbers study is the decline in the exvessel price of sac roe compared to 1990s prices. The sac roe markets for Alaskan herring have undergone enormous shifts forcing fisherman to adapt to lower prices and rising costs. Much like the reduction fishery that occurred at the start of the 20th century, the sac roe fishery is the victim of market forces that are beyond the capabilities of any one individual or government to change.

The sac roe fishery began in earnest in Kodiak in 1964 and is driven primarily by Japanese demand. This demand has fallen off in recent years for several reasons:

1. Japan has invested time, money, and effort into revitalizing its local herring stocks, which crashed in the 1950s. Starting in the 2000's Japan's yearly herring fisheries have steadily increased in magnitude. As of the writing of this paper, the 2024 Japanese herring harvest is set to be the largest on record since 1996, when Japan began herring revitalization work[41]. These herring do not have expensive shipping fees attached to them like herring harvested in Kodiak. These herring are both fresher and cheaper than Alaskan herring. In addition, Japan is taking a much more conservative approach to herring management, and stocks will likely continue to rebuild over coming decades.
2. The diets of Japanese consumers have become increasingly westernized. Cured sac roe is considered unhealthy by the younger generation, being very fatty and very salty. The demand for Alaskan sac roe is no longer what it was from the 1960s through the 1990s.

In short, the Japanese demand for herring is much lower overall, and local Japanese sac roe is now competing with imported Alaskan sac roe. This is clearly reflected in the price per ton paid for herring imported into Japan. Figure 2 (below) illustrates the long-term prices for sac roe herring imported into Japan from 1988 through 2023. The long-term trend is in blue, with the two-year forecast displayed in red. The prices show a remarkable amount of seasonality, with price spikes occurring around the New Year, when cured sac roe herring is traditionally consumed.

[41] Asakawa, 2024

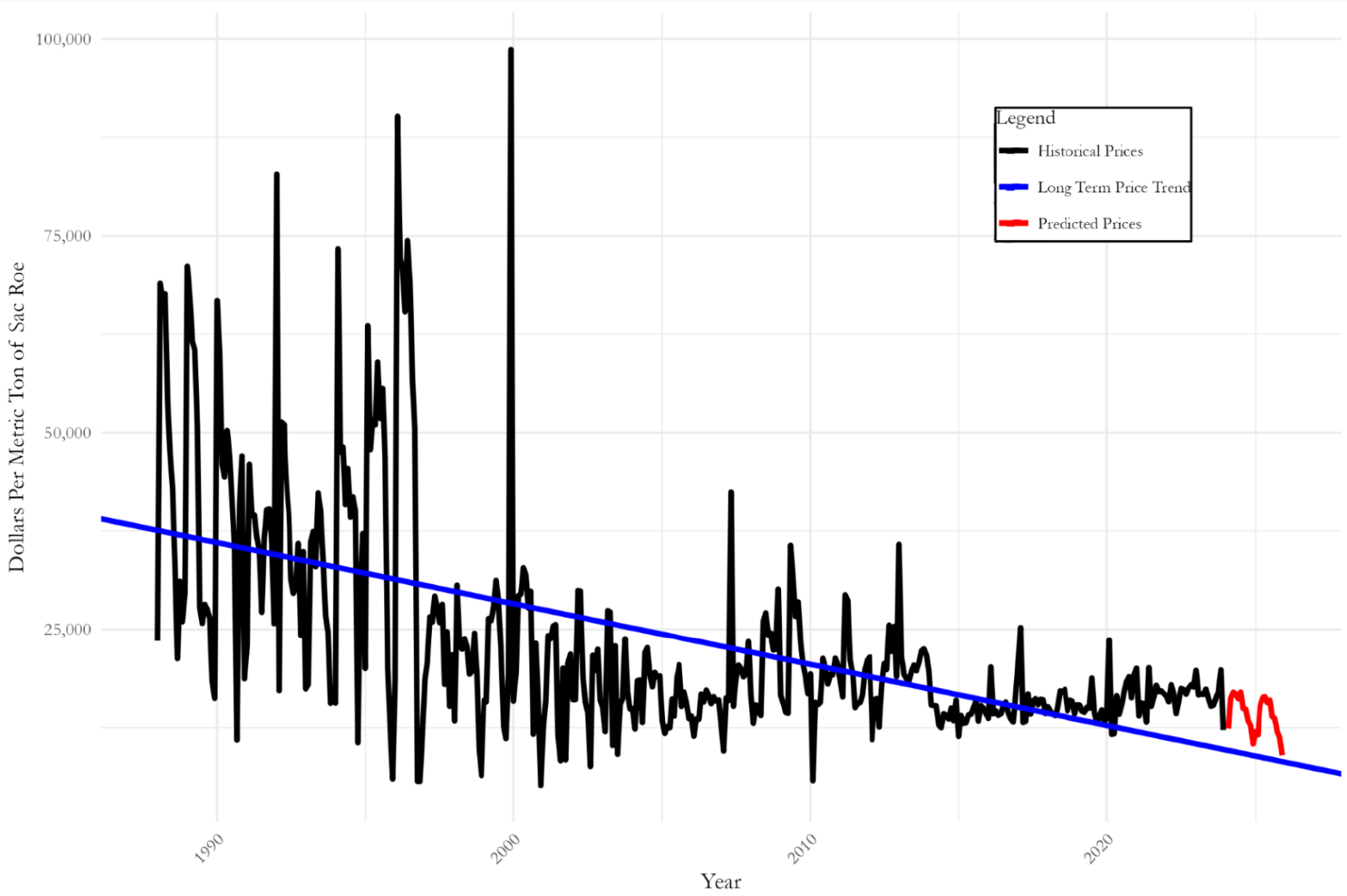

Figure 2: US Dollar per Metric Ton of Sac Roe Imported into Japan over Time. Note: 2 Year Forecast (2024 – 2025) in Red.

Herring markets have changed substantially, and in unexpected ways over the last century. No individual could have foreseen the decline of the reduction fisheries or the sudden overnight creation of the sac roe fisheries. It is not the purpose of this study to predict the future but rather to investigate whether the current number of CFEC Kodiak food and bait permits is the appropriate number considering current environmental and economic conditions. Past CFEC studies of herring attempted to predict exvessel prices based on Japanese market conditions and economic measures such as the Japanese yen and US dollar exchange rate. Rather than analyzing foreign markets, we present what has occurred in the past and predict that the sac roe markets will not return. Figure 3 (below) illustrates how drastically values paid to fishermen have decreased over the last 30 years for sac roe, while food and bait ex-vessel values remain largely the same.

When CFEC first limited the herring sac roe fisheries, and subsequently the food and bait fisheries, much of the value of herring came from the sac roe fishery. This is no longer the case. The individuals who petitioned CFEC make it clear that they wish to harvest herring for food, not for bait. Currently, there is no information on the commercial herring food fishery in Alaska, as Alaskan herring has not been sold for food in significant quantities since the 1950s.

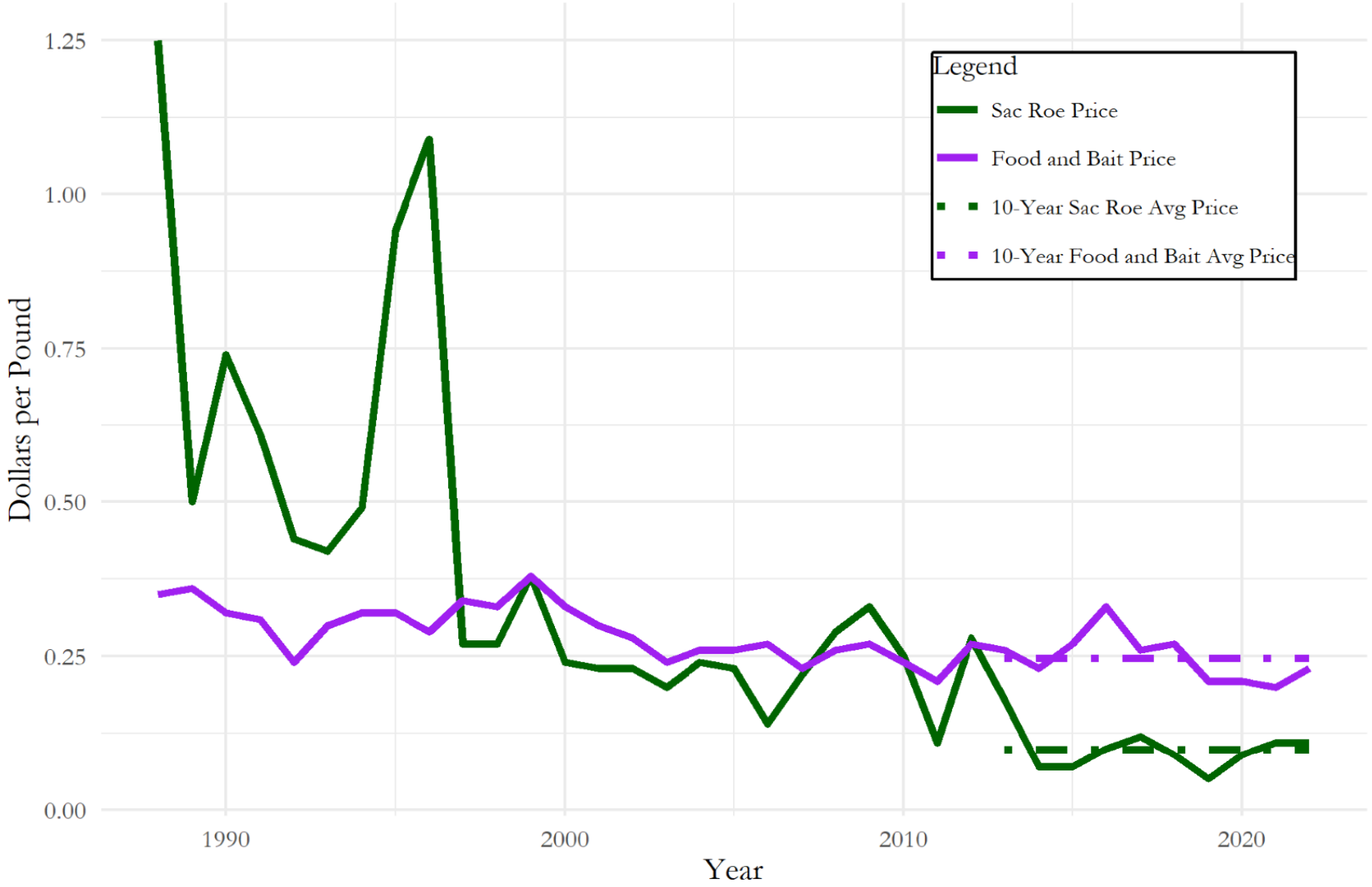

Figure 3: Herring Food and Bait and Sac Roe Price Per Pound by Year

4.0 An Examination of the Economic Optimum Number of Permits for the Kodiak Food and Bait Herring Fishery

This section first outlines the specific questions to address to determine the economic optimum number of limited entry permits for the Kodiak herring food and bait fishery, and then proposes a model to define the economic optimum number by taking these answer into consideration. It then details the required information to answer these questions, when information is unavailable assumptions are made to fill in knowledge gaps. Some of this information is available from existing data, while other data was collected by the CFEC through surveys or other methods. Commonly used data sets produced by CFEC will not be detailed here, as they are documented elsewhere in yearly CFEC publications.

4.1 Food and Bait Gross Revenue

The best predictor of the future is widely regarded to be the recent past. It is important to examine the historical gross revenue generated by the Kodiak food and bait fishery before attempting any analysis.

Table 2 below shows the recent gross revenues for the Kodiak food and bait herring fishery. These revenues were calculated by applying the average statewide herring food and bait price over the last 10 years (2013 – 2022) to tons of food and bait herring harvest as reported by ADFG in the 2022 Kodiak Herring Annual Management Report.

Table 2: Herring Food and Bait GHL, Harvest, Exvessel Value and Average Gross Earnings per Permit by Year, 2002 – 2022

Year	Food and Bait GHL (Tons)	Food and Bait Harvest (Tons)	Food and Bait Exvessel Value	Average Gross Earnings per Permit
2002	134	135	$75,545.89	$8,393.99
2003	197	199	$94,843.83	$10,538.20
2004	225	190	$96,902.62	$10,766.96
2005	302	168	$87,068.27	$9,674.25
2006	342	169	$92,941.38	$10,326.82
2007	370	154	$71,376.02	$7,930.67
2008	351	202	$103,095.14	$11,455.02
2009	420	263	$141,025.82	$15,669.54
2010	555	191	$92,355.26	$10,261.70
2011	405	212	$86,983.06	$9,664.78
2012	404	299	$161,833.80	$17,981.53
2013	454	291	$151,514.52	$16,834.95
2014	310	124	$57,537.83	$6,393.09
2015	113	106	$57,422.87	$6,380.32
2016	101	-	-	-
2017	129	77	$40,090.30	$4,454.48
2018	91	59	$31,569.65	$3,507.74
2019	111	121	$50,237.06	$5,581.90
2020	319	339	$143,914.31	$15,990.48
2021	720	685	$280,416.97	$31,157.44
2022	760	912	$416,347.16	$46,260.80
2013 - 2022 Average	311	302	$136,561.18	$15,173.46

Figure 4 shows average gross earnings over time. The most recent years for which CFEC information is available, 2021 and 2022, are the two highest years on record and well above the 10-year average of $15,173.46.

For the purposes of this optimum number study, we assume the average of the last 10 years of average gross revenue is a good representation of what permit holders can reasonably expect to make in the future. We note that 2021 and 2022 are both well above recent years in terms of harvest and earnings, however, there is no reason to exclude 2021 and 2022 from analysis. It would also be improper to simply use the most recent years as a measure of gross earnings. This study will use the 10-year average (2013 – 2022) as a measure of what the typical average gross earnings would be in any given year.

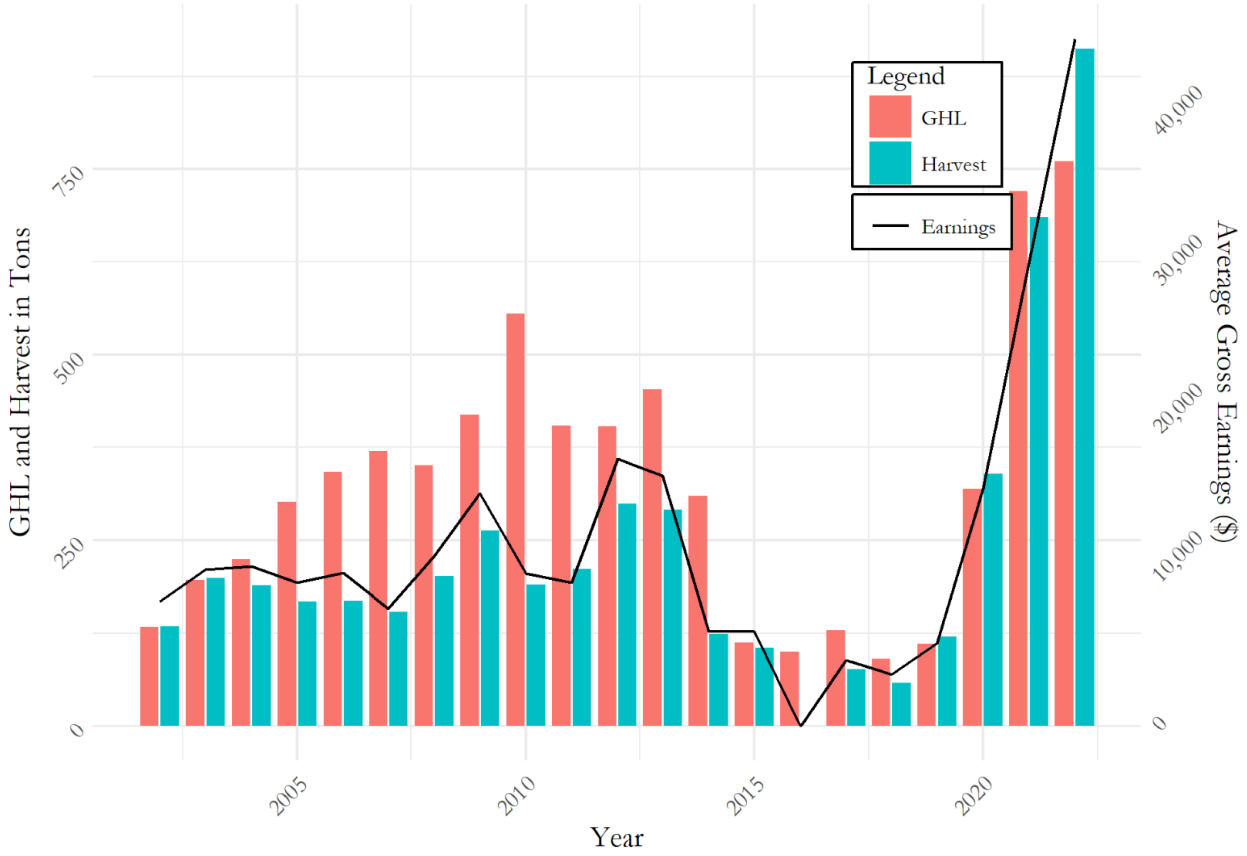

Figure 4: Harvest, GHL, and Average Gross Earnings Kodiak Food and Bait Herring, 2002 – 2022

Table 3 shows historical food and bait harvests as reported in the 2002 Kodiak Herring Annual Management Report and the CFEC Herring Limitation Study conducted in 2000. Much of this information is confidential due to the low level of participation. It is presented to illustrate that 2021 and 2022 harvests are high when compared to historical food and bait harvests going back to 1964 when the food and bait fishery started. Individuals interested in harvests for the historical herring reduction fishery in Alaska are encouraged to read the 1971 NOAA technical report number NMFS-SSRF-634, which provides biological statistics as well as historical harvests in Alaskan herring reduction fisheries.

Table 3:Kodiak Food and Bait Harvest by Year, 1964 – 2001.

Year	Food and Bait Harvest (Tons)	Year	Food and Bait Harvest (Tons)	Year	Food and Bait Harvest (Tons)	Year	Food and Bait Harvest (Tons)
1964	310	1974	40	1984	123	1994	135
1965	35	1975	5	1985	102	1995	101
1966	198	1976	0	1986	213	1996	93
1967	300	1977	0	1987	217	1997	83
1968	15	1978	399	1988	340	1998	Confidential
1969	11	1979	125	1989	344	1999	Confidential
1970	8	1980	381	1990	312	2000	Confidential
1971	44	1981	18	1991	215	2001	Confidential
1972	50	1982	326	1992	217		
1973	178	1983	33.4	1993	Confidential		

4.2 Methods

As previously mentioned in chapter 2 of this report, three key standards must be considered when determining the optimal number of limited entry permits for any Alaskan fishery. The first and third standards are economic in nature, and the second is referred to as the management standard.

The first and third standards state that the rate of return for participation in a limited entry fishery should be "reasonable" and that the revenue generated from participation in a fishery should generally be equal to the opportunity cost incurred by forgoing other activities. We take this to mean that the rate of return should be greater than zero and define the opportunity cost to be the median household income in the city of Kodiak, the largest community local to the Kodiak food and bait herring fishery.

The term "reasonable" is not explicitly defined in regulation, which makes setting a specific rate of return challenging due to variability and typically slim profit margins. Many fishermen consider a season successful if they can cover costs without incurring debt, allowing for boat maintenance, crew wages, and gear repairs. Essentially, all expenses are met. Consequently, we suggest that the rate of return should, on average, be greater than zero. However, this is not a guarantee; in any given fishing season, some fishermen profit while others incur losses. We believe that the number of permits issued should ensure that a majority (over 50%) of fishermen achieve a positive return.

We define opportunity cost by assuming that the median Kodiak household income according to the 2022 American Community Survey (adjusted to 2024 dollars) is the amount of money that a full-time fishermen would forgo[42]. The study avoided using *mean* income *per person* for the following reasons:

1. **Fishing is Often a Family Operation:** Families in Alaska often run family-based fishing operations, where all members contribute to generating revenue from fish harvests. Children often serve as deckhands and may eventually take over the family business. Partners frequently manage shopping, bookkeeping, and onshore logistics. The income from a fishing permit is expected to support not just the permit holder but the entire family unit. Thus, fishing is more akin to a family business venture than an individual employment opportunity. Exiting the fishery would necessitate children finding alternative employment

[42] U.S Census Bureau, 2022

and partners seeking gainful employment outside the family business. Even in situations where children are not deckhands, professional fishermen are often gone for long periods of time, making employment difficult for partners when child care is involved.

2. **Skewness of Data**: Income data is typically skewed, meaning there are several very high incomes that can disproportionately increase the mean (average) income. This makes the mean less representative of the typical earning experience of most people. The median, being the middle value in a list of numbers, is less affected by extremes on either end, and provides a better indicator of the central tendency of the income data.
3. **Household Dynamics**: Income per person can be misleading because it does not account for the economies of scale present in larger households. For instance, a household of four does not typically need four times the income of a single-person household to maintain a similar standard of living. Median household income considers the whole household's income together, which is a more accurate reflection of living standards. Mean also does not account for the fact that some members of a household do not work. Mean income is not a good representative measure because all individuals in a population are included, including children and other dependents that may not be able to work but still require support.
4. **Comparison Across Different Areas**: Comparisons of median household income across different regions or demographic groups are more meaningful than using mean income per person. This is because median income reflects the income level where half the households earn more and half earn less, providing a straightforward comparative measure without being skewed by outliers.
5. **Policy Making and Socioeconomic Analysis**: For policymakers and researchers, understanding the median household income helps in assessing the economic well-being of a typical household. This assists in crafting policies aimed at middle-income earners or identifying the needs of lower-income households, thereby addressing economic disparities more effectively.
6. **Stability Over Time**: Median values are generally more stable over time compared to means, which can fluctuate significantly with changes in the income of the wealthiest. Therefore, using median household income provides a more consistent basis for analysis and comparison over different periods.

The goal of this study is to determine the economic optimum number of limited entry fishing permits. This number should ensure that fishermen earn a reasonable income, which is set based on the median household income (in this case, $96,600 per year), and achieve a reasonable rate of economic return, that is, greater than zero. With this in mind, we can now propose a model.

Proposed Model

Let I(n) represent the net earnings for an individual fisherman when *n* permits are issued, it is equal to their average gross earnings (G) minus their costs (C).

1. $\boldsymbol{I(n) = G(n) - C}$

Average gross earnings is equal to the weight of all fish harvest (h) in the fishery in pounds (10-year average) multiplied by the price per pound, P (10-year average), and divided by the total number of permits.

2. $\boldsymbol{G(n) = (P * h)/n}$

Costs are equal to the sum of fixed costs (F) and variable costs (V) for a given fishing operation.

3. $\boldsymbol{C = F + V(t, h)}$

Variable costs of course depend both upon the time spent fishing, and the number of fish harvested. Some variables, such as crew share, scale with the amount of fish harvested (h), while others, such as fuel and food, scale with the time spent fishing (t).

Information about fixed and variable costs were obtained from a survey of 74 individual fishermen, which is detailed in the data sources and cost structure portion in subsequent sections, and in Appendix B. This information allowed an estimation of the distribution of incomes for the Kodiak food and bait fishery by using the cost information to calculate estimated net earnings for each of the 74 individual permit holders that responded to the email survey.

We thus end up with:

4. $\boldsymbol{I(n) = G(n, h) - F - V(t, h)}$

For each individual respondent ($\boldsymbol{i}$) we were able to estimate what their net earnings would be in the fishery if they were awarded one of *n* food and bait permits. Therefore, we can examine how one specific individual would have fared if there were 9 permits, 12 permits, or 100 permits. We do this for each of the 74 respondents. Therefore, the net earnings for any individual is:

5. $\boldsymbol{I_i(n) = G_i(n, h) - F - V_i(t, h)}$

We define $\boldsymbol{I}$ as the set of all net earnings.

6. $\boldsymbol{I = \{I_1, I_2, I_3 \ldots I_{74}\}}$

Our problem becomes finding *n* such that:

7. ***Q1(I) = Median Household Income***

and

8. ***Q3(I) = Median Household Income***

Where ***Q1*** represents the 25th percentile income of net earnings for all individuals, and ***Q3*** represents the 75th percentile of net earnings for all individuals.

The economic optimum number of limited entry permits is the range of n defined at the upper end by 25 percent of participants having net income greater than or equal to $96,600, and at the lower

end by 75 percent of participants having a net income greater than or equal to $96,600 when adjusted for the amount of time spent in the fishery.

The number of fish harvested (h) and the amount of time spent in the fishery (t) is variable from one year to another. We made assumptions regarding harvests and time spent in the fishery, as outlined in subsequent sections of this chapter.

Solving equations 7 and 8 for n when t and h are defined will give us a range of limited entry permits for the food and bait fishery that can be considered optimum according to the economic standards in the Limited Entry Act.

Parameters

Before defining all the variables used in our model, it is important to discuss the difference between primary fisheries and secondary fisheries. The Kodiak food and bait fishery is a secondary fishery, or a shoulder fishery. In shoulder fisheries, many fixed costs are already paid when a participant enters a primary fishery, such as a salmon fishery. These fixed costs are apportioned to a shoulder fishery only for the time spent directly participating in that fishery. This contrasts with primary fisheries, in which fixed costs can be directly attributed to participation in the primary fishery. In other words, shoulder fisheries are supplemental to primary fisheries. An example would be payments on vessel loans. Vessels are required for participation in a primary fishery and are paid for out of the primary fishery earnings. If someone participates in a shoulder fishery for only 7 days, we adjust vessel loan costs to seven days to reflect this when calculating costs.

As a central portion of the discussion around herring in recent years centers around reallocation of herring sac roe GHL into herring food and bait GHL, we also investigated scenarios in which this occurred. In these scenarios we assume that the food and bait fishery would no longer be a "shoulder" fishery but would start to take on characteristics of a primary fishery.

Prices

Gross earnings data was used to calculate an average statewide herring food and bait price per pound. This price per pound was used to calculate the average gross earnings for the Kodiak food and bait fishery by multiplying the harvest as reported by ADFG by the price per pound. We take the simple mean of the last 10 years of data (2013 – 2022) to be representative of what could typically be expected for average gross earnings in any randomly given year. The average price per pound for food and bait herring was just $0.25, while the ten-year average gross earnings (2013 – 2022) is $15,173. The average gross earnings in 2021 and 2022 were exceptionally high, but no justification exists for excluding those years from the data set (Figure 4).

Time Spent Fishing

The time spent in the fishery in any given year was defined as the time from the first delivery to the last delivery, in any given year, with two days of travel time for the food and bait fishery. The assumption was made that the simple mean of time spent fishing over the last ten years would be a good representation of the time that an individual could expect to spend in the fishery, which is equal to the time someone would have to forgo other money generating activities (opportunity cost). For the food and bait fishery, the mean time spent over the last ten years is approximately 7 days, or almost exactly .23 months (months on average have 30.4 days).

When considering the scenario in which the food and bait GHL would increase through reallocation to the food and bait fishery, either by merging permit types or via Board of Fisheries

action, we assumed that allocating the entire GHL to this fishery would result in a duration similar to the current sac roe fishery, approximately one month (28.5 days). We also assumed that any proportional allocation of the GHL would correspond to a proportional duration for the fishery. For instance, if 50% of the total GHL is allocated to the food and bait fishery, we estimated the fishery would last two weeks. Similarly, if 25% of the total GHL is allocated, the fishery would last about one week.

Median Household Income

The 2022 median household income as report by the US Census Bureau is $91,138 for the Kodiak Census Area, which when adjusted into February 2024 dollars is $96,566.08[43]. We posit that this median household income is a reasonable measure of opportunity cost, and any commercial permit holder should stand a reasonable chance of making this amount in any given fishing season when adjusted for the length of time spent fishing. This figure needs to be adjusted for the time spent in each fishing season. For food and bait herring, the season is generally a little under a week, with some variation from one year to the next. For the sac roe herring fishing season, the figure is significantly larger, roughly one month, although some variation again exists from one year to the next. Thus, when adjusting for time spent fishing (approximately 7 days), we end up with a target net earnings of $1,852 dollars for the food and bait fishing season.

When examining the hypothetical situation that food and bait GHL would increase through reallocation to the food and bait fishery, either by combining permit types or through Board of Fisheries action, we assume if the entire GHL was allocated to the food and bait fishery, this would result in a fishery that would take place over a time span comparable to the current sac roe fishery, or about one month. This results in an income over the span of one month of $8,047.17.

The opportunity cost for participating in the current food and bait herring fishery is $1,852, and the opportunity cost for participating in a hypothetical combined herring fishery (sac roe and food/bait) is $8,047.17 when all GHL is allocated towards food and bait.

Reasonable Rate of Economic Return

Rate of economic return is typically specified as a percentage, however "reasonable" lacks any definition in state statute regarding limited entry permits. We define reasonable for this analysis as any amount greater than zero.

Harvest and GHL

As a central portion of the discussion around herring in recent months centered around the possible reallocation of herring sac roe GHL to herring food and bait GHL, we investigate two definitions of harvest (h) using our proposed model. We first examine only the average food and bait harvest in the last 10 years. Secondly, we investigate various scenarios in which sac roe GHL is reallocated to the Kodiak food and bait herring fishery. We investigate scenarios in which 25%, 50%, 75%, and 100% of the sac roe GHL was reallocated to the food and bait fishery.

Fixed Costs

These are costs that do not vary with either the time spent fishing, or with the number of fish harvested. An example of a fixed cost would be the yearly permit fee or a vessel registration fee. Information regarding these costs was taken from fishermen themselves in a CFEC email survey

[43] U.S Census Bureau, 2022

(Appendix B), from Kodiak vendors, and from publicly available information, such as dock fee schedules or CFEC fee tables.

Variable Costs

These are costs that vary with either the time spent on fishing or with the number of fish harvested. An example of a cost that varies with harvest would be crew share or bait (for fisheries that require bait). An example of costs that vary with time spent fishing would be fuel, food, or generator maintenance. Information regarding these costs was obtained through a CFEC email survey (Appendix B) in which fishermen communicated details about crew fees, fuel usage, repair costs, and more. Variable costs were then adjusted according to their scalar variable: either time (t), or quantity of fish harvested (h).

Data Sources

CFEC Gross Earnings File

The CFEC gross earnings files were used to generate statewide herring food and bait prices. The CFEC gross earnings data is based on ADFG fish tickets and augmented with CFEC permit holder and other data. The exvessel value for herring fisheries in the CFEC gross earnings data largely comes from the Commercial Operators Annual Report and ADF&G fish tickets with some additional information provided by processors. ADF&G herring districts and subdistricts are determined from statistical areas on fish tickets. Several processes to validate and enhance fields such as vessel number and statistical area are undertaken on a yearly basis.

CFEC Transfer Survey Files

Since 1980, the commission conducted mandatory surveys during the transfer of permits, gathering essential data on the costs associated with permits and any vessels involved in these transactions. This data is pivotal in accurately determining the expenses related to seine vessels in Kodiak. Our study incorporates this survey data alongside information derived from the US stock exchange, and interest rates provided by the Alaska Division of Investments (DOI), a division of the Alaska Department of Commerce, Community and Economic Development, and CFAB. This approach enables us to report the financial impact on permit holders concerning the acquisition of vessels and permits by calculating opportunity and financing costs.

CFEC Vessel Files

CFEC has expansive records pertaining to vessel registration. When registering a vessel for the season, permit owners must fill out a vessel registration form, which contains many questions about the vessel length, value, tonnage, and more. This information was used to generate statistics about potential vessels that could participate in the food and bait fishery.

CFEC Email Survey Results

CFEC has robust data regarding harvests, gross earnings, and exvessel values, however there is a lack of information regarding the costs fishermen must pay to participate in commercial fisheries in Alaska. This lack of information makes difficult any analysis of economics, rates of return, or reasonable net incomes. No consistent database exists that outlines costs fishermen must pay on a yearly basis.

In addition, a unique challenge has arisen in collecting economic data specifically for the food and bait herring seine fishery. As mentioned before, this fishery operates as a combine, and many of

the permits are owned by the same family unit. Information was provided by a food and bait permit holder, but relying solely on this data could potentially skew the results.

To mitigate this risk and ensure a broader understanding of the economic dynamics, a survey was distributed to all seine permit holders in the Kodiak area, aiming to capture a comprehensive view of both fixed and variable costs associated with their fishing operations. This approach assumed that the economic factors influencing the herring seine fishery are similar to those affecting other seine fisheries, such as the salmon seine fishery.

The survey was launched on February 27, 2024, targeting all seine permit holders within the region. To maximize response rates and ensure comprehensive feedback, follow-up emails were sent at one-week intervals over a three-week period, with the survey officially closing on April 19th. A total of 337 individuals were emailed. There are total of 438 seine permits for the Kodiak management area (salmon and herring combined).

The CFEC email survey elicited feedback from 91 participants. Among these, only one respondent answered the survey in regard to herring fishing, while the remaining 90 provided insights related to their experiences with salmon seine (S01K) permits. For the analytical purposes of this study, 74 responses were considered, excluding 17 for the reasons detailed below:

- Eight respondents had retired and were no longer active in the industry.
- Six surveys were significantly incomplete.
- Three responses were received after the survey deadline.

Significant variability in costs was observed, particularly concerning insurance and maintenance expenses. In smaller-scale fisheries, such as those for food and bait, these costs can be prohibitively high, thereby diminishing the financial viability for many participants. Similarly, the variability in maintenance costs can render certain fisheries unprofitable, depending on the vessel and the specifics of the operation.

Appendix B provides a detailed description of the survey and responses.

Vendor Information

In parallel to the survey, staff from the commission engaged directly with various vendors in Kodiak. These interactions were aimed at obtaining current and relevant economic data specific to operational costs not covered by the survey. This included gathering information on fuel prices, utility rates, and harbor fees. The combination of direct survey data and vendor information is believed to provide a fairly accurate picture of both fixed and variable costs associated with seine fishing in the region. This dual approach allowed for a more robust analysis, compensating for any potential biases or gaps in the survey data alone[44, 45].

Cost Structure

This outlines the potential fixed and variable costs that fishermen might incur to participate in the Kodiak food and bait herring fishery. The available data in this fishery is sparse, with a limited number of permits—typically, only one permit is active each year as mandated by ADFG. Additionally, the fishery is characterized by its small scale and cooperative operation mode, predominantly involving permit holders from the same family. Consequently, it would be

[44] City of Kodiak, 2024
[45] City of Kodiak, 2018

inaccurate to project the expenses of these current participants onto potential new entrants. This study presupposes that the operational costs for running a single seine permit are consistent across different fisheries. This assumption is based on the uniformity in gear types, crew requirements, and fishing methods, allowing the study to approximate costs for an average "everyman" fisherman entering this fishery.

Most of this section will focus on outlining methodology used to come up with opportunity and financing costs for permits and vessels. Permits and vessels are the two most expensive items an individual must have to participate in any fishery in Alaska. Both limited entry permits and vessels have prices that typically range from tens of thousands to hundreds of thousands of dollars. Opportunity costs and financing costs can be very expensive on a yearly basis.

In addition to covering the costs of permits and vessels, this section will also go over methodology used to apply information gained through permit holder surveys and vendor communications into fixed and variable costs specific to the herring food and bait survey.

Permit Values and Costs

For any income generating asset, we assume that the market value of that asset represents the current value of any future income generated minus the opportunity cost. This holds true for limited entry permits[46]. Limited entry permits are valued based upon expectations about GHL, perceived market prices for herring, ability to harvest, and previous experience in the fishery.

In order for any purchasing or selling of a permit to take place, two things must occur:

1. For the seller, the value of what they are getting for their permit by selling it must be more valuable than any future perceived income that could be generated from the permit.
2. For the buyer, the future perceived value (income) of the permit they are buying must be more than what they are giving up purchasing it, including any potential income that could be generated from the money they are giving up.

Every individual values items differently, and value is not limited to money. In the hands of a skilled fishermen, a limited entry permit is much more valuable than in the hands of someone who has never stepped foot on a commercial vessel. The more skilled a fisherman is, the more that fishermen will value a limited entry permit, because they can potentially make more money from it when compared to a less skilled fisherman.

There are many instances where permits are sold significantly above or below the average market value because either the buyer values that permit higher, or the seller does not place a high value on the permit. Individuals who start fishing as deckhands may eventually gain enough skill fishing to the point that the purchase cost of a permit does not compare to the potential earnings from that permit. Likewise, a fisherman that suffers an injury that prevents them from fishing will subsequently value their limited entry permit less, and perhaps be willing to sell it. Over a long enough period, every permit will be in the hands of an individual who can get the maximum value (monetary or otherwise) from that permit.

In the Kodiak food and bait fishery, there are four different permit types. Seine and gillnet gear for vessels up to 60 feet in length, trawl gear for vessels up to 60 feet in length, trawl gear for vessels up to 65 feet in length, and trawl gear for vessels up to 75 feet in length. The trawl permits have

[46] Karpoff, 1984

never fished in the Kodiak food and bait herring fishery; ADFG has required since this fishery entered limited entry that the permits be fished cooperatively, and only seine permits have been used in that combine to harvest herring.

CFEC normally calculates permit values through one of two methods. The first method is a time-weighted average of the last four transactions adjusted for inflation. The second method involves using the average gross earnings to make an estimate of what a permit is valued at, as permit value is a function of potential income. It is impossible to place a value on the trawl permits in the Kodiak food and bait herring fishery using normal CFEC methods for the following reasons:

1. Trawl limited entry permits for the food and bait fishery have never posted earnings. Average gross earnings can be used to approximate permit value, and in many fisheries, yearly fluctuations in gross earnings explain much of the variability in fluctuations in permit values. With no earnings information available from the trawl permit types, it is impossible to use this method of approximation to determine value. The last time trawl permits participated in the Kodiak food and bait herring fishery was the late 1990's, before limited entry.
2. These permits have only ever rarely been purchased or sold. As a result, transaction information is both confidential, and lacking in enough observations to come to any conclusions as to permit value.

Therefore, we are forced to use alternative methods to quantify the value of the trawl permit types. Putting aside the differences between gear type, harvest, and efficiency, we instead consider that because the fishery operates as a cooperative, it is appropriate to treat trawl permits much the same as seine permits when it comes to their market values. All permits are part of the same cooperative, and as only seine gear is used to harvest food and bait herring, we can treat each permit as if it is bestowing some ownership in the cooperative and rights to the associated pool of earnings.

Figure 5 (below) shows the values of the H1DK permit type over time. H1DK permits are issued for the harvest of food and bait herring using seine or gillnet gear with a vessel size restriction of up to 60 feet. This figure shows that permits have changed hands relatively rarely in the Kodiak food and bait fishery.

Permits are often highly priced due to their significant potential for future income, beyond just their immediate financial value. This potential, however, comes with associated costs such as opportunity cost and financing costs.

Opportunity cost refers to the value of the capital employed. Typically, transactions such as exchanging money for a fishing permit are seen as equitable exchanges where each party relinquishes something of value to get something in return. Parting with an asset also means that an individual forfeits all future benefits that asset might have generated. These forgone benefits represent lost opportunities and are thus considered a cost. In economic terms, opportunity cost is frequently calculated as the potential income forgone had the money been invested elsewhere. There is no way of knowing what any given individual would do with a large sum of money. Some may buy rental property, invest in the stock market, or start a business. Therefore, we assume that the opportunity cost of a fishing permit is equivalent to what could have been earned by investing the permit's market value in the stock market. The long-term average rate of return for the New York Stock Exchanges Standard and Poor's (S&P) 500 is often used as a benchmark for such calculations. While individual returns can vary, with some exceeding and others falling below the

S&P 500 average return, it is widely accepted as a reliable indicator of opportunity cost. As of the writing of this paper, the S&P 500 long-term average rate of return is 9.95%. Therefore, the annual opportunity cost of owning a H1DK permit, which is currently valued at $136,700 is $12,986.

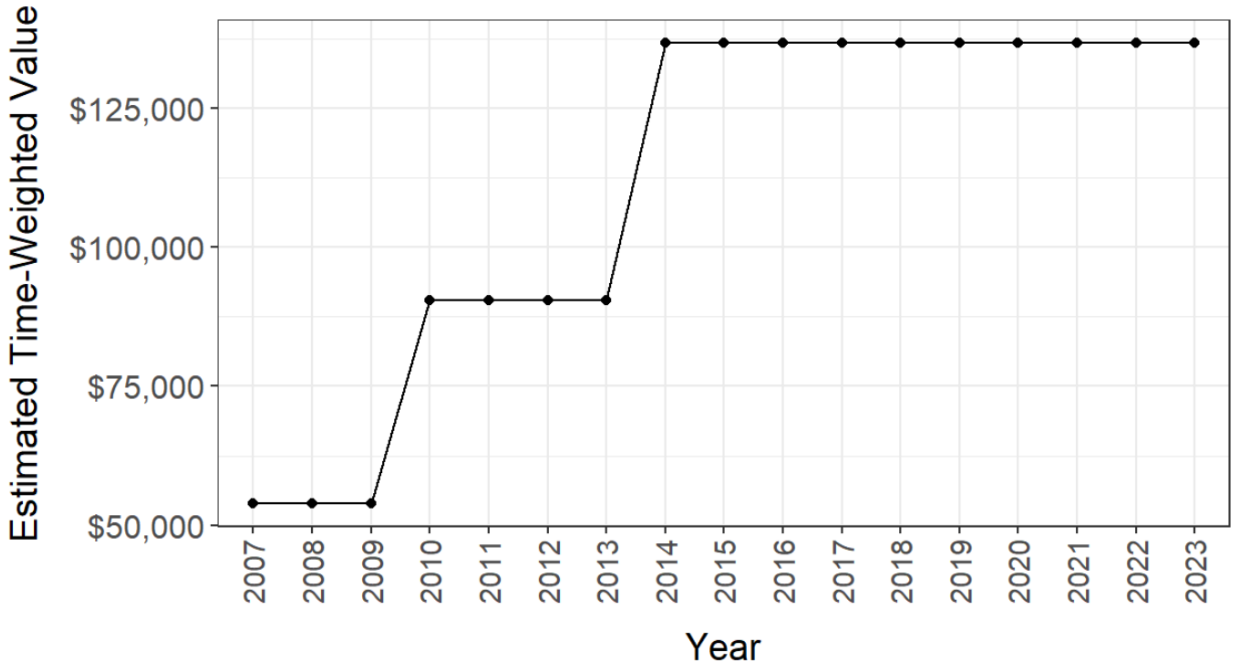

Figure 5: H1DK Permit Values by Year, 2007 – 2023.

If money is borrowed to purchase a permit, borrowers must make monthly payments against both the principal of the loan, and the interest accrued. Payments to the principal are considered the repayment of borrowed capital. Payments to capital reduce the amount owed and cannot be considered a new expense, and they do not impact on the profitability of a business. Payments to interest, however, are considered a cost. Interest can be thought of as the cost paid for using the lender's money. Interest has an impact on net income, involves special tax considerations, and reduces the profitability of the business.

There are two organizations in Alaska that have the power to place liens on commercial fishing permits, which effectively means that these are the only two organizations willing to lend to individuals for the purchase of a fishing permit, as no others can hold a limited entry permit as collateral. The entities are CFAB, and DOI. CFAB does not publish interest rates, but personal communications indicate the loans for permits have a variable interest rate, and currently sit at around 9.25%, which of course can vary depending on the circumstances of the individual. DOI publishes interest rates of the writing of this report at the quoted rate for commercial fishing permits loans at 10.50%[47].

H1DK permits are currently valued at $136,400. Any new permits issued in this fishery would be valued based upon the current value of H1DK permits, as CFEC is required to offer these permits at fair market value. While there are certainly individuals who have enough cash on hand to purchase a $136,700 limited entry permit outright, it is a reasonable assumption that many

[47] DOI, 2024

individuals would take out a loan for this amount. We estimate that the cost of financing a permit would be $13,499.

The final financial impact of permit ownership can be thought of as the sum of the opportunity cost of the capital used, as well as the cost of the loan (interest expenses).

Vessel Values and Costs

Alaska Statute 16.05.835 prohibits salmon seine vessels over 58 feet in length, while 20 AAC 05.823 allows a maximum vessel length of 80 feet to participate in the Kodiak food and bait herring fishery, but breaks down vessel sizes into categories A – D. Size category A is for vessels 80 feet in length or less, B is for vessels 75 feet in size or less, C is for vessels 70 feet or less, and D is for vessels 60 feet in length or less. Given the limitations in salmon seiner size, that trawl permits have not fished in this fishery since the late 1990's, and that only herring seine permits have participated and no seine permits exists for vessels greater than 60 feet in length (regulations provide for them, but none were ever created) any expansion of the fishery would likely take place with vessels 58 feet or less. Regulations do allow for the use of 60-foot vessels according to CFEC.

CFEC vessel files were used to calculate the median vessel price for a Kodiak seine vessel between 25 and 60 feet. This median price, based upon data reported by permit holders when registering their vessel to fish, is $300,000. Based upon this value and using the S&P 500 long term average interest rate of 9.95%, we calculate the yearly opportunity cost for a vessel to be $28,500. This value is apportioned over the time spent in the fishery.

CFEC has very little information regarding the interest paid on vessels, and the breakdown between interest and principal. The CFEC permit owner survey (Appendix B) provides information as to if a permit holder has financing or some other payments arrangement on their vessel. This information still lacks a breakdown between principal and interest payments. Any surveys requesting this information would likely garner no response.

To calculate interest rates and the cost of financing, CFEC used information collected from permit holders at the time of permit transfer as well as information from CFAB and the current prime interest rate[48]. The current prime interest rate is 8.5% as of May 8, 2024. We calculate the cost due to interest by comparing the current prime interest rate to the CFAB interest rates. We then examine the historical prime interest rate over the last 15 years and assume that the difference between the prime interest rate and the current published interest rates is constant. We calculate the average imputed interest over the last 12 years, as the life of vessel and permit loans is typically 12 years according to CFAB. We calculate this to be an average annual rate of 5.3%. Therefor the cost of financing a vessel valued at $300,000 on an annual basis is $16,000.

True interest rates likely vary greatly based upon individual credit score, down payments, and more. It should be noted the CFAB interest rates that are not fixed according to the prime interest rate, but we believe that individual lender interest rates generally vary as the prime interest rate varies. This rough approximation of the cost of financing is the best information available.

Other Costs

The study included the following costs as part of a proposed cost structure:

[48] Personal Communication Lela Klingert CEO CFAB 4/30/2024 Interest rates are variable, loan length is 12 years on average, 9.25% is about the average rate (depending on credit, on time payments, and more).

Maintenance and Upgrade Costs: Information about these costs was obtained from CFEC permit holders through the email survey (Appendix B). These costs were provided on a yearly basis and apportioned to the Kodiak food and bait herring fishery based upon the fishery taking one month to prosecute.

Insurance Costs: Information about this cost was obtained from CFEC permit holders through an email survey (Appendix B). These costs were provided on a yearly basis, and apportioned to the Kodiak food and bait herring fishery based upon the time a permit holder must devote to the fishery. Insurance is usually billed monthly, so insurance costs were rounded to one month. It is not expected that this fishery would ever take more than a month to prosecute.

Logistics Costs: Information about this cost was obtained from CFEC permit holders through an email survey (Appendix B). These costs include transportation costs such as airline tickets, and shipping, but exclude vessel fuel. These costs were provided on a seasonal basis, and apportioned to the Kodiak food and bait herring fishery based upon the amount of a permit holder must devote to the fishery as a proportion of the amount of time a permit holder has to devote to the Kodiak salmon seine fishery.

Dock and Storage Fees: Information about this cost was obtained from CFEC permit holders through an email survey, and published city of Kodiak dock rates. These costs are provided on a seasonal basis, and adjusted for time a permit holder must devote to the Kodiak food and bait herring fishery as compared to the Kodiak salmon seine fishery.

Vessel, Permit, and Inspection Fees: These fees were obtained from the CFEC published fee tables, the Alaska Department of Motor Vehicles, and the US Coast Guard. Except for the permit fee, these fees are provided for on a yearly basis and adjusted based upon the amount of time spent in the fishery. The CFEC permit fee is a flat fixed fee and is not adjusted.

Communications: This cost includes cellular and internet plans. This cost was obtained from published Starlink rates. Other companies aside from Starlink provide vessel connectivity plans, but Starlink is by far the cheapest. This cost is provided monthly and adjusted for time that would be billed to the Kodiak food and bait fishery: one month.

Fuel Costs: This cost was calculated with information obtained in the CFEC email survey. Survey respondents indicated their fuel consumption in gallons for a salmon season, which we then used to calculate a daily fuel consumption rate. This daily rate was then adjusted to the number of days spent in the food and bait fishery and multiplied by the quoted cost of diesel fuel from Petro Marine Services in Kodiak, a leading supplier of fuel in Kodiak.

Crew Share: Permit holders were asked to provide the percentage of their gross earnings that accounted for crew share. On average, permit holders indicated that 35% of their gross was used to pay out crew members. A dollar value was calculated by taking 35% of the average gross earnings, where gross earnings was the total value of the fishery divided by the hypothetical number of permits.

Cost Structure Model and Summary

Two models were used to define costs in this optimum number study, the first was used to estimate costs for the Kodiak food and bait fishery, treating this fishery as a shoulder fishery with many costs apportioned to the fishery only for time (proportion of a month or months) spent in the fishery.

$$
\begin{aligned}
Costs = (\, & annual\ vessel\ interest + annual\ permit\ interest \\
& + annual\ maintenance\ expenses + annual\ insurance \\
& + annual\ docking\ and\ storage) * months\ active/12 + \\
& (\, seasonal\ food + seasonal\ logistics + seasonal\ electrical + \\
& seasonal\ docking\ costs) * months\ active\ /\ length\ of\ the\ fishery + \\
& (vessel\ registration\ fee + vessel\ inspection\ fee)\ /\ 2.36 + \\
& communications + crew\ share\ percentage * average\ gross\ earnings
\end{aligned}
$$

The second model was used to estimate costs for the expanded GHL fishery, which assumed that the fishery was a primary fishery, with many costs apportioned as fixed costs on a seasonal basis for the fishery.

$$
\begin{aligned}
Costs = (\, & annual\ vessel\ interest + annual\ permit\ interest \\
& + annual\ maintenance\ expenses + annual\ insurance \\
& + annual\ docking\ and\ storage)\ /\ 12 + \\
& (\, seasonal\ food + seasonal\ logistics + seasonal\ electrical + \\
& seasonal\ docking\ costs)\ /\ length\ of\ the\ fishery + \\
& (vessel\ registration\ fee + vessel\ inspection\ fee)\ /\ 2.36 + \\
& communications + crew\ share\ percentage * average\ gross\ earnings
\end{aligned}
$$

Vessel registration and inspection fees are fixed annual costs and are divided by the average number of fisheries an individual is expected to participate in, plus one. This calculation assumes that new entrants to the Kodiak food and bait fishery are already participating in an average of 1.36 fisheries and would be participating in 2.36 fisheries if they entered the food and bait fishery as a new participant.

Food, docking, electrical, and logistics costs, reported as total costs for a salmon seining season in our survey, were adjusted based on the expected duration in the food and bait fishery, assuming these costs are consistent across fisheries. For shoulder fisheries, these costs are apportioned according to the expected time spent in the fishery (fractions of a month). For primary fisheries, we round this duration to one month, assuming the fishery will operate as a primary fishery for that period.

Communications fees are a flat fixed fee for a month. Crew share fees are calculated by multiplying the average gross earnings (total gross earnings / number of permits) by the crew share percentage reported in the CFEC email survey.

Table 4, below, gives an outline of a hypothetical costs for participation in the Kodiak food and bait herring fishery. This cost structure is based on CFEC data, surveys, and vendor quotes for those who choose to participate. For one week of participation in the fishery, we estimate an individual to pay $10,812.77 if gross earnings are split evenly among the currently existing 9 permits. Appendix C presents this information in the form of a income statement.

Table 4: Proposed Kodiak Food and Bait Seine Cost Structure

Estimate of Costs to Participate in a Kodiak Food and Bait Seine Fishery		
Maintenance and Upgrade Costs	$	1,092.72
Insurance Costs (For the Season)	$	524.63
Logistics Costs (Air Tickets, Cabs, Hotels)	$	254.92
Vessel Registration Fee (CFEC and DMV)	$	54.24
Permit Fee	$	150.00
Coast Guard Inspection Fee	$	450.42
Dock and Storage	$	125.45
Electrical Connection for Vessel	$	47.08
Food	$	459.41
Communications	$	250.00
Fuel Fees	$	1,795.03
Crew Share	$	5,343.11
Annual Vessel Opportunity Cost	$	28,500.00
Vessel Interest	$	144.14
Annual Permit Opportunity Cost	$	12,958.00
Permit Interest	$	121.62

Opportunity costs for vessels and permits are included as a part of this cost structure as they are costs that must be considered when individuals are making business decisions. However, these opportunity costs are not used in calculations for net earnings. These costs represent the forgone benefits that could have been realized if resources had been allocated differently. Standard financial statements and calculations aim to present an objective and quantifiable view of a business's financial status based on real cash flows and expenditures. Including the discussion of opportunity costs for permit and vessel ownership in an analysis highlights that potential missed opportunities or alternative investment strategies could have led to different financial outcomes.

5.0 Economic Optimum Number Results

This chapter focuses on the evaluation of the model presented in the previous chapter for both the current food and bait fishery, as well as hypothetical scenarios in which GHL changes.

5.1 Evaluation of the Food and Bait GHL Model and Economic Results

Table 5, presented below, details the outcomes of our proposed model under the current 9.1% GHL for the Kodiak food and bait herring fishery. Our analysis, informed by comprehensive survey results and vendor pricing data, evaluates the economic implications of varying the number of fishing permits. As noted in chapter four, we expect participation in the food and bait fishery to

carry an opportunity cost of $1,852. This opportunity cost is based upon the yearly median income in Kodiak ($96,566) adjusted for the time spent in the fishery (approximately one week).

Table 5: Estimated Net earnings with Current 10% GHL

	Target Income: $96,556 GHL = 9.1% Time = .23 Months Target Income Adjusted for Time: $1,852 **Optimum Number Range: 11 - 15**		
Permits	25 Percentile	Median	75 Percentile
5	$10,780	$12,996	$14,076
6	$7,885	$10,041	$11,013
7	$5,772	$7,906	$8,863
8	$4,345	$6,269	$7,268
9	$3,304	$5,006	$6,016
10	$2,458	$4,009	$5,023
11	**$1,679**	$3,184	$4,216
12	$996	$2,496	$3,506
13	$419	$1,914	$2,904
14	-$60	$1,415	$2,415
15	-$401	$989	**$1,998**
16	-$703	$628	$1,637
17	-$991	$309	$1,318
18	-$1,283	$26	$1,037
19	-$1,553	-$228	$789
20	-$1,795	-$456	$565

With eleven permits active, the data reveals that 75% of the fishermen (representing the top three quartiles) are projected to earn at least $1,679 per week. This suggests a relatively favorable earning potential for a significant majority of participants under a more restricted permit scenario. On the other hand, expanding to 15 permits reveals a stark contrast; only the top 25% of fishermen are expected to earn $1,998 or more. This delineation highlights the diminishing returns on individual earnings as permit numbers increase.

The particularly low GHL in this fishery complicates the landscape further. As more permits are issued, the resultant earnings must be divided among a greater number of participants, inherently lowering the average gross income per fisherman. If 15 permits are issued, our model predicts that the bottom 25 percent of participants will lose $401 or more if they choose to participate. This loss scales as the number of permits increases. The intent of the petitioners to broaden participation in the food and bait fishery is clear, yet after an exhaustive investigation—encompassing all associated surveys and an in-depth analysis of the costs tied to fishing—we find a sobering picture. This fishery's unique and challenging nature makes it a difficult arena to generate profit.

Issuing more than 15 permits would likely exacerbate the issue of permit latency, as evidenced by recent trends in Alaska's herring fisheries where many permits remain unused on a yearly basis.

This observation is critical as it not only impacts the economic feasibility for fishermen but also raises concerns about the sustainable management of fishery resources. By capping the number of permits, we aim to strike a balance between economic viability and ecological sustainability, ensuring that the fishery can continue to provide for the community without depletion.

5.2 Economic Results with 100% Guideline Harvest Level Allocated to Food and Bait

Table 6 presents the results when assuming that various levels of sac roe GHL are reallocated to the food and bait fishery. As mentioned in the previous section this would result in the food and bait fishery no longer being viewed as a shoulder fishery, instead becoming a primary fishery like many sac roe fisheries throughout the state. In such a scenario, many fixed costs are increased as the food and bait fishery would no longer be supplemental to other primary fisheries. We make the following assumptions in these hypothetical GHL reallocation scenarios:

1. First, we set *h* equal to some proportion of the average of the combined harvest for both the sac roe and food/bait fisheries from 2013 – 2022 (10 years). This proportion is defined by what percentage of the total GHL could possibly be reallocated to the food and bait fishery and is noted at the top of table 6.
2. We assume that *t,* the time it would take to prosecute a fishery with a higher GHL would be equivalent to some proportion of the total time it has taken to prosecute the sac roe fishery over the last 10 years. This proportion is defined by the GHL percentage at the top of table 6. The total real time (in months) is also given. Some variable costs that scale with time are billed monthly (such as communications, or vessel payments).

Table 6 shows the results of our model when various amounts of GHL reallocated to the food and bait fishery. The results are interesting. As GHL increases, the number of participants that can participate and make positive net incomes increases. Due to the monthly billing nature of many of the large costs associated with the fishery, such as vessel and permit interest payments, the number of participants that can reasonably participate in the fishery (the optimum number) is lower than what would occur if we continued to treat this fishery as a shoulder fishery.

The results show that there is a significant overlap in the economic optimum number of limited entry permits for all GHL levels. If 25% of the total GHL is allocated to the food and bait fishery, the economic optimum number is between 15 and 23 permits, while if 100% of the GHL is allocated to the food and bait fishery, the economic optimum number of permits is between 30 and 44 permits.

It should be emphasized that the Kodiak sac roe historical market conditions are not likely to come back. As explained in chapter 3, the market for sac roe has changed drastically. When the sac roe herring fishery was limited in Kodiak, CFEC originally issued 85 seine permits, two seine/gillnet permits, and 119 gillnet permits. As of 2023, There are 60 active seine permits, two active seine/gillnet permits, and 74 active gillnet permits. Inactive permits were cancelled by CFEC, resulting in 136 current permits in the Kodiak sac roe fishery. Out of all the permits that currently exist in the Kodiak sac roe fishery, only nine fish on a consistent annual basis, and all are seine permits. The gillnet sac roe herring fishery in Kodiak is effectively extinct. Even with 100% of the sac roe GHL moved to the food and bait fishery, current prices are not capable of supporting 145 permits (136 sac roe permits and nine food and bait permits).

Table 6: Estimated Net earnings with Expanded 100% GHL

Target Income = $96,566												
	GHL = 25% time = .25 Months Target Income Adjusted for Time: $2,012 **Optimum Number Range: 15 - 23**			GHL = 50% time = .50 Months Target Income Adjusted for Time: $4,024 **Optimum Number Range: 22 - 33**			GHL = 75% time = .75 Months Target Income Adjusted for Time: $6,035 **Optimum Number Range: 27 - 40**			GHL = 100% time = 1 Month Target Income Adjusted for Time: $8,047 **Optimum Number Range: 30 - 44**		
Permits	25 Percentile	Median	75 Percentile	25 Percentile	Median	75 Percentile	25 Percentile	Median	75 Percentile	25 Percentile	Median	75 Percentile
10	$9,453	$13,655	$15,508	$27,485	$34,400	$37,906	$47,492	$55,810	$59,547	$67,834	$76,874	$81,678
11	$7,380	$11,565	$13,310	$23,813	$30,190	$33,637	$41,030	$49,455	$53,045	$59,452	$68,352	$73,040
12	$5,571	$9,800	$11,481	$20,668	$26,654	$29,985	$35,841	$44,120	$47,513	$52,346	$61,028	$65,678
13	$4,272	$8,302	$9,933	$17,964	$23,764	$26,855	$31,581	$39,678	$42,951	$46,200	$55,056	$59,418
14	$3,073	$6,971	$8,606	$15,646	$21,298	$24,172	$28,179	$35,632	$39,082	$40,933	$49,773	$54,050
15	**$2,078**	$5,817	$7,456	$13,694	$19,014	$21,847	$25,131	$32,098	$35,737	$36,695	$45,425	$49,445
16	$1,105	$4,807	$6,461	$12,078	$16,928	$19,782	$22,368	$29,036	$32,822	$32,978	$41,578	$45,466
17	$289	$3,916	$5,586	$10,474	$15,160	$17,974	$19,814	$26,382	$30,250	$29,572	$38,088	$41,955
18	-$408	$3,124	$4,836	$8,922	$13,518	$16,383	$17,675	$24,129	$27,964	$26,500	$35,037	$38,854
19	-$1,051	$2,415	$4,188	$7,622	$12,048	$14,994	$16,003	$22,114	$25,840	$23,749	$32,232	$36,127
20	-$1,629	$1,777	$3,605	$6,510	$10,725	$13,709	$14,374	$20,339	$23,938	$21,695	$29,719	$33,660
21	-$2,152	$1,200	$3,082	$5,424	$9,528	$12,546	$12,841	$18,653	$22,243	$19,711	$27,415	$31,408
22	-$2,628	$676	$2,606	**$4,422**	$8,462	$11,489	$11,420	$17,079	$20,636	$17,881	$25,301	$29,349
23	-$3,062	$197	**$2,172**	$3,549	$7,511	$10,524	$10,257	$15,642	$19,167	$16,396	$23,408	$27,478
24	-$3,460	-$242	$1,779	$2,749	$6,639	$9,653	$9,033	$14,325	$17,820	$15,030	$21,743	$25,768
25	-$3,826	-$646	$1,417	$2,013	$5,862	$8,866	$7,866	$13,114	$16,623	$13,729	$20,178	$24,194
26	-$4,164	-$1,019	$1,043	$1,394	$5,150	$8,125	$6,806	$11,995	$15,534	$12,458	$18,708	$22,755
27	-$4,477	-$1,364	$695	$803	$4,490	$7,415	**$5,833**	$10,959	$14,531	$11,207	$17,348	$21,427
28	-$4,768	-$1,685	$372	$214	$3,877	$6,754	$4,935	$10,030	$13,601	$10,029	$16,085	$20,193
29	-$5,039	-$1,983	$71	-$330	$3,307	$6,140	$4,099	$9,188	$12,736	$8,892	$14,909	$19,036

-continued-

Table 6: Estimated Net earnings with Expanded 100% GHL

Target Income = $96,566												
	GHL = 25% time = .25 Months Target Income Adjusted for Time: $2,012 **Optimum Number Range: 15 - 23**			GHL = 50% time = .50 Months Target Income Adjusted for Time: $4,024 **Optimum Number Range: 21 - 31**			GHL = 75% time = .75 Months Target Income Adjusted for Time: $6,035 **Optimum Number Range: 24 - 36**			GHL = 100% time = 1 Month Target Income Adjusted for Time: $8,047 **Optimum Number Range: 21 - 31**		
Permits	25 Percentile	Median	75 Percentile	25 Percentile	Median	75 Percentile	25 Percentile	Median	75 Percentile	25 Percentile	Median	75 Percentile
30	-$5,291	-$2,262	-$209	-$805	$2,775	$5,574	$3,319	$8,402	$11,928	**$7,802**	$13,811	$17,902
31	-$5,528	-$2,522	-$472	-$1,249	$2,277	$5,048	$2,590	$7,649	$11,172	$6,783	$12,784	$16,841
32	-$5,749	-$2,752	-$718	-$1,675	$1,810	$4,560	$1,906	$6,931	$10,478	$5,827	$11,821	$15,847
33	-$5,957	-$2,947	-$949	-$2,100	$1,371	**$4,105**	$1,333	$6,252	$9,845	$4,930	$10,917	$14,912
34	-$6,153	-$3,131	-$1,167	-$2,500	$958	$3,680	$829	$5,614	$9,257	$4,085	$10,066	$14,033
35	-$6,338	-$3,305	-$1,362	-$2,877	$569	$3,279	$353	$5,012	$8,703	$3,288	$9,263	$13,227
36	-$6,512	-$3,484	-$1,545	-$3,233	$201	$2,900	-$95	$4,444	$8,149	$2,536	$8,505	$12,487
37	-$6,677	-$3,666	-$1,717	-$3,570	-$146	$2,541	-$542	$3,906	$7,605	$1,918	$7,788	$11,793
38	-$6,833	-$3,839	-$1,881	-$3,890	-$476	$2,201	-$983	$3,396	$7,090	$1,382	$7,109	$11,136
39	-$6,984	-$4,004	-$2,036	-$4,192	-$788	$1,879	-$1,401	$2,913	$6,601	$873	$6,481	$10,515
40	-$7,128	-$4,165	-$2,183	-$4,480	-$1,085	$1,575	-$1,833	$2,454	**$6,137**	$390	$5,896	$9,930
41	-$7,265	-$4,318	-$2,323	-$4,754	-$1,367	$1,286	-$2,243	$2,017	$5,695	-$70	$5,340	$9,375
42	-$7,395	-$4,464	-$2,457	-$5,014	-$1,636	$1,011	-$2,637	$1,601	$5,274	-$517	$4,810	$8,846
43	-$7,519	-$4,604	-$2,584	-$5,271	-$1,893	$748	-$3,039	$1,205	$4,881	-$954	$4,305	$8,341
44	-$7,638	-$4,736	-$2,705	-$5,527	-$2,120	$498	-$3,424	$826	$4,507	-$1,372	$3,823	**$7,859**
45	-$7,753	-$4,863	-$2,821	-$5,772	-$2,327	$262	-$3,791	$464	$4,149	-$1,841	$3,363	$7,399
46	-$7,870	-$4,984	-$2,932	-$6,006	-$2,524	$36	-$4,142	$118	$3,807	-$2,292	$2,922	$6,959
47	-$7,982	-$5,094	-$3,039	-$6,230	-$2,714	-$180	-$4,478	-$213	$3,480	-$2,727	$2,501	$6,543
48	-$8,089	-$5,200	-$3,141	-$6,445	-$2,895	-$387	-$4,801	-$531	$3,166	-$3,156	$2,096	$6,147
49	-$8,192	-$5,302	-$3,236	-$6,651	-$3,069	-$585	-$5,110	-$835	$2,865	-$3,568	$1,709	$5,767
50	-$8,291	-$5,399	-$3,327	-$6,849	-$3,236	-$776	-$5,406	-$1,127	$2,576	-$3,964	$1,336	$5,402

6.0 The Management Optimum Number Standard

The second optimum number standard pertains to fisheries management and how ADFG management biologists respond to harvest effort levels. Given that this standard is applied to the in-season management of a fishery, CFEC does not consider it appropriate to define this metric independently. Instead, CFEC defers to the expertise of ADFG. The management optimum number for the Kodiak food and bait herring fishery was determined to be one. The management optimum number for a food and bait herring fishery that has an expanded GHL is a more difficult number to pin down, the results of that discussion, and the memos generated from that discussion (Appendices D and E) are summarized here to inform any future actions that may be taken by either the board of fish or CFEC.

6.1 Overview of Management

Management biologists are tasked with considering a multitude of factors to successfully manage a fishery. The ADFG mission statement outlines this responsibility:

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

The sustained yield principle is a management paradigm that ensures natural resources, such as fish, can be harvested indefinitely. This is achieved by managing the resources in a manner that prevents the harvest from exceeding the regenerative capacity of the specific resource in question. The management optimum number can be thought of as the number of limited entry permits that both allow for the orderly harvesting of the entire GHL within a calendar year, while still avoiding significant risk of over-exploitation given the ability of the resource to regenerate within a specific timeframe.

Herring fisheries, as one example, are managed according to a fixed exploitation rate management strategy, contrasting with the escapement-based management system used for salmon. As forage fish, herring can regenerate a certain percentage of their total biomass annually, although this percentage can vary based on ocean conditions, the proportion of sexually mature individuals, and other factors. Most management plans in Alaska presume herring can regenerate between 10 and 20 percent of their total biomass each year, with this percentage increasing alongside the total biomass. For instance, a spawning biomass of 100 tons might regenerate on 10% of total biomass in a year (10 tons), whereas a biomass of 1,000 tons could regenerate 20% (200 tons). It is important to note that these examples are simplified for illustrative purposes, and CFEC does not claim expertise in these biological specifics.

The number of issued limited entry permits is crucial when managing a herring fishery; too many permits can lead to unsustainable harvest levels, which contradicts the departments mandate to harvest in accordance with sustained yield. Contra wise, too few limited entry permits can result in underutilization of the GHL, meaning that money is being left on the table in the form of unexploited resources, more than what is needed for a sustainable yield producing population, this would contradict the mandate to manage resources in the best interest of the state's economy and the well-being of its people.

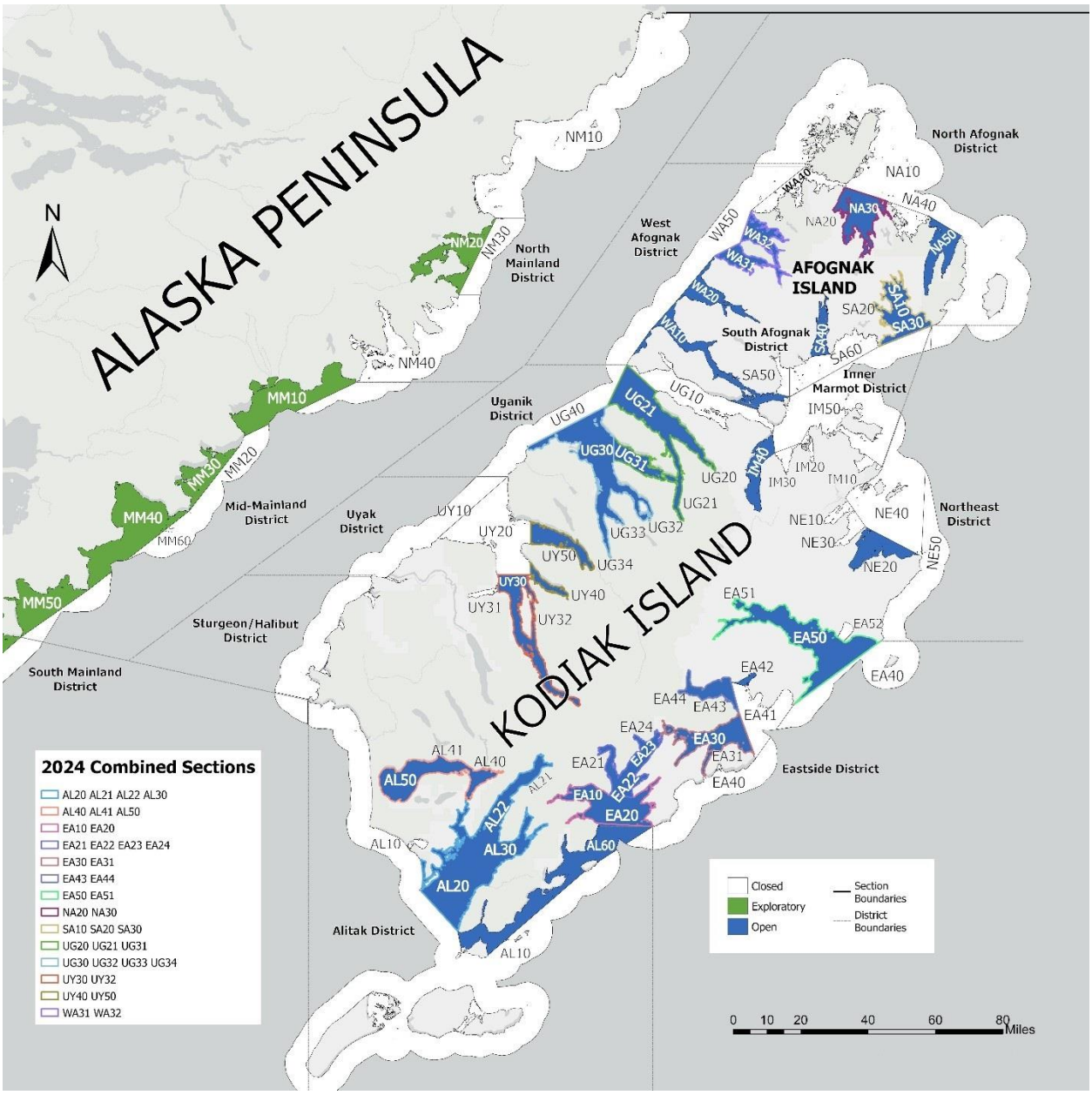

Figure 6: Kodiak Management Area, Districts, and Sections

Another complexity arises from the fact that herring in Kodiak are not managed as an area wide aggregate. They are managed based on GHLs that are set section by section (Figure 6). The Kodiak management area is made up of 13 herring districts, each of which is composed of between one and 16 sections. A large area wide GHL may economically support multiple vessels harvesting, but that GHL may be composed of many small section level GHLs which could easily be overharvested by even one vessel. Without allocative regulations in effect to prevent this, ADFG may be hesitant to allow multiple vessels to harvest even when total area GHL is high. ADFG does not make any allocative decisions during the prosecution of a fishery, allocative decisions are solely the purview of the Board of Fisheries.

6.2 Defining the Management Optimum Number

In April of 2024 CFEC requested input from ADFG regarding the management optimum number of limited entry permits. This memo, included as Appendix D, asked the following questions:

1. In 2022, the GHL for the Kodiak herring food and bait fishery was 760 tons, which is the largest GHL since 2001. What is the **minimum** number of **seine** permits that would be needed to harvest a GHL of 760 tons for the herring food and bait fishery in an orderly manner, assuming that only seine permits participate.
    a. CFEC currently issues four otter trawl permits for vessels that range in length from under 60 feet, up to 75 feet. If all four otter trawl permits were to take part in the fishery, how does the answer to the above question change?
2. In 2018, the GHL for the Kodiak herring food and bait fishery was 91 tons, which is the lowest GHL since 2001. What is the **maximum** number of **seine** permits that could be fished in order to harvest a GHL of 91 tons for the herring food and bait fishery in an orderly manner?
    a. Given the harvest capacity of otter trawlers, CFEC assumes that 91 tons is too low of a GHL to allow any fishery if otter trawlers intend to participate in harvest activities.
3. In 2018, the herring GHL was 1,276 tons for both herring fisheries combined. What is the **maximum** number of **seine** permits that could be fished in order to harvest a GHL of 1,276 tons in an orderly manner if we assume that the four otter trawl permits are participating?
    a. In addition to that question, we ask what is the maximum number of seine permits that could be fished in order to harvest that GHL if the four trawl permits were converted to seine permits?
4. In 2022, the herring GHL was 8,835 tons for both herring fisheries combined. What is the **minimum** number of **seine** permits that would be needed in order to harvest a GHL of 8,835 tons in an orderly manner if we assume that the four otter trawl permits are participating?
    a. And again, we ask what is the minimum number of seine permits that could fish in this scenario if the four trawl permits were converted to seine permits?

The first two questions in the memo request ADFG input on the management optimum number for the current food and bait fishery. ADFG responses to these questions can be found in Appendix E. The response by the department makes it clear that the management optimum number for the food and bait fishery as it currently is set up, is one. The low section level GHLs mean that even during years of area wide abundance, the risk of overharvest is too large. In 2022 when the area wide GHL was 760 tons, many sections had a GHL of 40 tons, given that many seine vessels have harvest capacities of 100 tons, there is no way to prosecute an orderly and sustainable fishery when more than one seine vessel participates. The department goes on to point out that trawl permits have even larger harvesting capacities, and if trawl permits were to competitively participate instead of joining a cooperative, they would be hesitant to open the fishery at all.

The second two questions in the memo request input from ADFG about how the fishery would be managed if all the GHL was allocated from the sac roe fishery to the food and bait fishery. Even in years of abundant herring with an increased GHL, the management optimum number would be someplace between one and six seine vessels assuming only seine/gillnet permits could participate.

If trawl permits fished the department indicates that they would be hesitant to even prosecute the fishery.

7.0 Conclusion and Recommendations

7.1 Optimum Number Recommendation for the Expanded Food and Bait GHL

It is recommended that the optimum number of limited entry permits for the Kodiak food and bait fishery be set as a range of 1 to 15 permits. This range balances economic and management standards, which can sometimes conflict. Economically, the fishery can support multiple permit holders, but from a management perspective, under current regulations, the resource can only sustain effort from a single vessel. Regulations define economic and management optimum numbers as ranges; when these ranges overlap, balancing the standards is straightforward. In this case, there is no overlap, so expanding the optimum number range to encompass both the management and economic optima is appropriate. This recommendation aligns with the current management paradigm, where only one vessel harvests at a time, and permit owners have formed a cooperative to facilitate this process.

Simply adopting the economic optimum range (11-15) would necessitate issuing at least two additional permits, bringing the total number of limited entry permits to 11, which cannot be fished under the current management paradigm. Conversely, adopting the management optimum number of one would likely result in an exclusive right to the fishery, deemed unconstitutional.

Thus, a balanced approach, expanding the optimum number range to include both economic and management considerations, is recommended for the Kodiak food and bait fishery.

7.1 Recommendations for the Expanded Food and Bait GHL

The economic optimum number of permits, if the entire GHL is allocated to the food and bait fishery, is estimated to be between 31 and 46 permits. This range reflects the fishery's potential to support multiple permit holders under ideal conditions.

The management optimum number is critical to ensuring sustainable harvest levels that prevent over-exploitation. Given the section-by-section GHL management strategy, even high area-wide GHLs can lead to overharvest in specific sections if not carefully managed. The input from ADFG makes it clear that expanding this fishery to additional permit holders is not simply a matter of allocating more GHL to the harvest of food and bait. Without some allocative regulations put into effect to restrict harvest in sections with low GHL, ADFG would be unable to prosecute a fishery.

To address potential overharvesting concerns, especially in areas with low GHLs, the Board of Fisheries could implement gear restrictions, such as allowing only gillnets to limit harvest effort in sections with low GHL. This approach would enable multiple vessels to operate in sections with larger GHLs without risking overharvest. Additionally, considering the conversion of existing trawl permits to seine permits could mitigate the risk posed by the high efficiency of trawl gear, promoting more balanced and sustainable fishing practices.

Ultimately, the future allocation of GHL between the food and bait fishery and the sac roe fishery remains uncertain. However, with the work presented in this paper, it becomes feasible to examine different scenarios under which the food and bait fishery could take place. Based on what has been examined so far, we are confident that the upper limit of the optimum number of limited entry permits lies between 31 and 46 permits if all GHL is allowed to be harvested as food or bait. The

true optimum number is likely somewhat lower than this and would be restricted by what ADFG can comfortably manage, the level of GHL allocated towards food and bait, and restrictions on gear type and area.

In conclusion, a balanced approach that considers both economic and management perspectives is essential for the sustainable future of the Kodiak food and bait fishery. By incorporating adaptive management strategies and responsive regulations, the fishery can achieve both economic viability and ecological sustainability, benefiting the state's economy and the well-being of its people.

References Cited

1985 Op. Att'y Gen. (May 23; 366-279-85).

Asakawa T. 2024. *Hokkaido Herring Landings Hit 7000 Tons From January to May*. Seafoodnews.com. June 21, 2024. Story No. 1280091. obtained June, 2024.

Baker J. and B. Muse. 1979. *Summary of Cost and Net Return Information for the Bristol Bay Drift Gill-Net Fishery.* Rpt No 70-01N. Commercial Fisheries Entry Commission. Juneau.

Burkey C. and Reid J. 1988. *Statistics of the Commercial Fishery for Pacific Herring from the Kodiak Area, Alaska.* Technical Fishery Report 88-11. Alaska Department of Fish and Game. Juneau.

City of Kodiak. 2023. *Schedule of Fees, Charges, and Tariffs.* https://www.city.kodiak.ak.us/sites/default/files/fileattachments/finance/page/347/fee_schedule_20230701.pdf obtained 5/1/2024

City of Kodiak. 2018. *Ship Yard Fee Schedule.* Harbor Masters Office. https://www.city.kodiak.ak.us/ph/page/ship-yard-fee-schedule obtained 5/1/2024

Commercial Fisheries Agricultural Bank. 2010. Website: History. 2010. https://www.akleg.gov/basis/get_documents.asp?session=26&docid=7110 obtained 5/15/2024

Commercial Fisheries Review. June 1963. Vol. 26 No. 6. Pages 20 – 21. US Fish and Wildlife Service, Bureau of Commercial Fisheries. Washington DC.

Commercial Fisheries Review. February 1962. Vol. 25 No. 2. Pages 78 – 79. US Fish and Wildlife Service, Bureau of Commercial Fisheries. Washington DC.

Division of Investments. 2024. *Published Interest Rates.* State of Alaska Department of Commerce, Community, and Economic Development. https://www.commerce.alaska.gov/web/inv/InterestRates.aspx obtained 5/1/2024

Fineberg H. and A. G Johanson. 1967. *Industrial Use of Fish Oils.* Circular 278, Chapter 16, Pages 222-238. US Fish and Wildlife Service, Bureau of Commercial Fisheries. Washington DC.

Fisheries Management and Conservation Act (*Magnusen Stevens Act*). 1976. Public Law 94-265.

Fuerst B. A. 2023. *Kodiak Management Area Herring Fisheries Annual Management Report, 2022.* Alaska Dept. of Fish and Game, FMR No. 23-21, Anchorage.

March C. M. and J. N. Cobb. 1910. *The Fisheries of Alaska 1909,* Bureau of Fisheries Doc. No. 730. Washington, DC.

Gretsch D. 1992. *Kodiak Management Area 1992 Commercial Herring Sac Roe and Food/Bait Fisheries: A Report to the Board of Fisheries.* Regional Information Report 4592-40. Alaska Department of Fish and Game, Kodiak.

Johns v. Commercial Fisheries Entry Com'n, 758 P.2d 1256 (Alaska 1988).

Karpoff, J. M. 1984. *Insights from the Markets for Limited Entry Permits in Alaska.* Canadian Journal of Fisheries and Aquatic Science. Vol 41. Pages 1160-1166.

Laws, E. A. (1997). El Niño and the Peruvian anchovy fishery. United States: University Science Books.

Mackovjak J. 2022. *Alaska Herring History*. University Press of Colorado. Louisville, Colorado.

Malecha P. W. 2000. *Kodiak Food and Bait Herring Fishery. CFEC Confidential Briefing Report* Rpt Num 00 – 2C. Commercial Fisheries Entry Commission, Juneau

Martin J. B. 1979. *A Report Submitted to the Commercial Fisheries Entry Commission*. Environmental Services Limited.

Morita, S. 1985. *History of the Herring Fishery and Review of Artificial Propagation Techniques for Herring in Japan.* Canadian Journal of Fisheries and Aquatic Science. Vol. 42. Pages 222 – 229.

Owers J. E. 1977. *Income Estimates and Reasonable Returns in Alaska's Salmon Fisheries*. Fishery Bulletin. Volume 75 No 3.

Pacific Fishermen Yearbook. 1922. *1922 Alaska Herring Pack Breaks Record.* Pages 95 – 96. Seattle.

Pigott G. M. 1967. *Production of Fish Oil.* Circular 277, Chapter 13, Pages 183 – 192. US Fish and Wildlife Service, Bureau of Commercial Fisheries. Washington DC.

Reid G. M. 1971. *Age Composition, Weight, Length, and Sex of Herring,* Clupea pallasii*, Used for Reduction in Alaska, 1929 – 1966.* NOAA Technical Report NMFS SSRF 634. Seattle, Washington.

Rickey, R. A. and A. Adasiak. 1977. *1976 Annual Report.* Commercial Fisheries Entry Commission, Juneau.

Rickey R. A., C. J. Stovall and J. N. Garner. 1976. *1975 Annual Report*. Commercial Fisheries Entry Commission, Juneau.

Spalinger, G. 2014. *Kodiak Management Area Commercial Herring Food and Bait Fishery Harvest Strategy, 2014.* Alaska Dept. of Fish and Game, FMR No. 14-48, Anchorage.

Spalinger, G. 2018. *Kodiak Management Area Herring Fisheries Annual Management Report, 2016.* Alaska Dept. of Fish and Game, FMR No. 18-23, Anchorage.

Tveteras S., Paredes C. and Pena-Torres, J. 2011. *Individual fishing Quotas in Peru: Stopping the Race for Anchovies*. Marine Resource Foundation. https://www.researchgate.net/publication/254423921_Individual_Fishing_Quotas_in_Peru_Stopping_the_Race_for_Anchovies

US Census Bureau. 2022. *American Community Survey, 2022*. https://data.census.gov/table/ACSST5Y2022.S1901?g=050XX00US02150 obtained 5/25/2024.

Appendix A: Petition to Examine Kodiak Food and Bait Herring Optimum Number of Limited Entry Permits

Appendix A: Petition to Examine Kodiak Food and Bait Herring Optimum Number of Limited Entry Permits

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10/2/2023

CFEC Commissioner Glenn Haight

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907-789-6150

Subject: Request for Issuance of Limited Entry Permits for the H1DK Herring Food/Bait Purse Seine Fishery in Kodiak, Alaska

Dear Commissioner Haight:

We are writing to express our concern regarding the current monopolization of the H1DK, Herring Food/Bait Purse Seine Fishery in Kodiak, Alaska, and to formally request the issuance of limited entry permits in accordance with the provisions set forth in Alaska Statutes AS.16.43.300 and AS.16.43.330.

According to the Alaska State Constitution Article VIII section 15: "*No exclusive right or special privilege of fishery shall be created or authorized in the natural waters of the State. This section does not restrict the power of the State to limit entry into any fishery for purposes of resource conservation, to prevent economic distress among fishermen and those dependent upon them for a livelihood and to promote the efficient development of aquaculture in the State.*"

The current H1DK permits are all registered under the same mailing address and the same vessel ADFG number despite the fact that some individuals listed as owners of those permits do not actually reside at that address, and it should be noted that for nearly two decades, a single vessel has participated in the fishery making deliveries to one of the 5 seafood processing companies in Kodiak despite a desire from other herring fishermen to participate in the fishery, and a demand from additional processors to have access to buy that bait/food herring. Additionally, since the initial issuance of permits for the food/bait and sac roe herring fisheries, the economics of the herring industry as a whole has shifted from the predominant value being in the sac roe herring fishery to the value now being in the bait herring fishery. The initial issuance of 5 total permits, which were easily

consolidated by a singe entity, is now insufficient to meet the economic needs and potential productivity of this fishery.

It is imperative the CFEC address the pressing issue of exclusive right of access for the H1DK fishery in Kodiak. The current situation not only undermines the principles of fairness and access that underlie our state's fisheries management, but it also jeopardizes the economic stability and long-term health of our coastal communities. As a result of this consolidation of access, and lack of processor competition, fishermen participating in other fisheries such as the halibut, tanner crab, and pot cod fisheries are faced with paying hyper-inflated costs for bait herring, further exacerbating the economic difficulties in maintaining profitable fisheries businesses.

It should also be noted that the current biomass of herring in the Kodiak Management area is of a magnitude never seen before.

The limited entry system, as established by AS.16.43.330, was designed with the aim of preventing monopolization and ensuring a level playing field for all participants. It seeks to strike a balance between economic stability and preventing overcapitalization, while safeguarding the interests of local fishermen. By allowing one entity to exert undue control over this fishery, we risk the degradation of the herring population and the broader marine ecosystem, while also placing excess economic hardship on participants of other fisheries reliant on the bait herring product.

We are committed to adhering to the guidelines and regulations set forth by the Alaska Department of Fish and Game and the CFEC. We are prepared to provide any necessary documentation, demonstrate our readiness, and the readiness of our vessels to participate, and comply with all relevant regulations to demonstrate our dedication to responsible fishing practices. We understand that our request may seem unusual or extreme, but we believe that this is likely the only limited entry fishery in the state that is completely (and unconstitutionally) controlled by a single entity.

We kindly request your intervention and support in rectifying the current situation and facilitating the process for issuing additional limited entry permits for the H1DK Food/Bait Herring Fishery. It is our sincere hope that through your assistance, we can restore balance and equity to this vital fishery.

Thank you for your time and consideration of this pressing matter. We understand this letter should pass through the CFEC research section in order to validate claims of current participants in the H1DK fishery, and we look forward to the opportunity to speaking with you and hearing any concerns or answering any questions you may have.

Should you require any further information or clarification, please do not hesitate to contact us at:

Nate Rose: [redacted]

Darren Platt: [redacted]

Sincerely,

Nathaniel Rose and Darren Platt

Appendix B: CFEC Kodiak Seine Vessel Cost Survey

Cover Letter and Survey

Hello [FirstName],

The Commercial Fisheries Entry Commission is conducting a survey investigating the costs that permit holders must burden in order to participate in seine fisheries around the Kodiak management area. This survey is designed to collect information about fixed and variable costs.

We would appreciate your input. Your answer will help us examine the economic health of the seine fisheries around Kodiak.

If you own more than one seine permit, you will receive multiple emails. Please answer this survey for the [Permit Type] permit that you own, with serial number [Permit Serial Number].

Thank you for your time. If you have any questions, please feel free to email or call.

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Kodiak Seining Vessel Cost Survey
Assessment of Fixed and Variable Costs in the Kodiak Seine Fisheries

Please answer the following questions to the best of your ability. Your responses will help in understanding the cost structure of participating in the Kodiak seine fisheries. For each question, select the answer that best describes your situation.

This survey often refers to fixed costs, variable costs, and gross income.

Fixed costs are those costs that do not change regardless of the amount of fish a permit holder harvests. An example of this would be a registration fee or an insurance bill.

Variable costs are costs that change, usually increasing, with the amount of fish a permit holder harvests. An example of this would be fuel used per day, the cost of ice used to keep fish cool, or the amount of money paid to a deckhand or crew member. All of these costs increase based upon the level of harvest.

Gross income is defined as the total value of all the fish harvested, **without** any costs accounted for, such as fuel, crew shares, or fees.

If you own more than one seine permit for the Kodiak area, please answer this survey specifically for the permit indicated in the email sent to you.

Fixed Costs

This portion of the survey assesses fixed costs.

Fixed costs are those costs that do not change regardless of how many fish are harvested. Examples would be insurance, finance payments, or permit fees.

1. Do you own your vessel outright, have a lease, financing, or some other arrangement?
- I own my vessel free and clear.
- My vessel is financed.
- I lease my vessel (short-term).
- I lease my vessel (long-term).
- Other (please specify).

2. If you lease or have financing for your vessel, what is the monthly payment?
- I own my vessel outright and do not make payments.
- My monthly payment is:

3. Do you and your vessel participate in more than one fishery?
- Yes.
- No.

4. Out of all the fisheries this vessel participates in, what percentage of time is specific to seine fisheries around Kodiak?

5. Please estimate your annual expenditure on vessel maintenance and upgrades.

6. What is your annual insurance cost for your vessel?

7. What are your annual docking or storage fees?

8. What is the cost of food and other provisions for yourself and the crew during the typical seining season? If you participate in more than one seine fishery, please provide the total for all seine seasons combined.

9. Can you please estimate your costs due to transportation and other logistics (excluding fuel, which will be accounted for in a following question)?

10. Are there other fixed costs that are not accounted for? If so, what are they?

- No.
- Yes (please specify).

Variable Costs

This portion of the survey assesses variable costs.

Variable costs are costs that change depending upon the amount of fish harvested. Examples would be fuel used per day, or crew share paid to deckhands.

Gross income is defined as the total earnings from all fish harvested, without any costs (such as crew share or fuel) accounted for.

11. How many gallons of fuel does your vessel used over the course of participating in Kodiak seine fisheries?

12. What percentage of your **gross income** do deckhands or members of the crew get altogether for the Kodiak seine fisheries? Please answer this question for all crew members combined. For example, if you have two deckhands that each get 10% of the gross income, the answer would be 20%.

13. Are there other variable costs that should be included? If so, what are they, and how do they vary? For example, salt per ton of fish harvested.

Appendix C: Income Statement for the Kodiak Food and Bait Fishery

Theoretical Income Statement Based on 2013 – 2022 Average Herring Food and Bait Harvest, CFEC Cost Survey, and Vendor Information

Sales

Herring Sold	$15,173.46

Costs

Variable Operational Costs

Crew Share	$5,343.11
Fuel	$1,795.03
Maintenance and Upgrade Costs	$1,092.72
Food	$459.41

Operating Costs

Insurance Costs (For the Food and Bait Season)	$524.63
Logistics Costs (Air Travel, Cabs, Hotels, Shipping)	$254.92
Docking and Storage	$125.45
Electrical Connection for Vessel	$47.08
Communications	$250.00

Administrative/Regulator Costs

Vessel Registration Fee (DMV and CFEC)	$54.24
Permit Fee (2023 CFEC Permit Fee)	$150
Coast Guard Inspection Fee	$450.42

Interest Costs

Vessel Interest	$144.14
Permit Interest	$121.62

Net Income	***$4,360.69***

Note: Statement based upon 10-year (2013 -2022) average harvests and CFEC costs survey (Appendix B), as well as vendor information. In most fisheries, the top quartile of harvesters often accounts for %50 or more of the total pounds landed. Most participants typically make much less than the simple mean (average).

This income statement is for the entire Kodiak food and bait season. This season is typically much shorter than a month. For a detailed explanation of how these costs were calculated and apportioned to the food and bait season, please see page 37 of this report.

Appendix D: Request for Management Optimum Numbers from the Alaska Dept. of Fish and Game

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Commercial Fisheries Entry Commission
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www.cfec.state.ak.us

To: Doug Vincent-Lang, Commissioner
Department of Fish and Game

Date: April 1, 2024

From: Glenn Haight, Chair/Commissioner
Mike Porcaro, Commissioner

Subject: Kodiak Food and Bait
Optimum Number Request

The Commercial Fisheries Entry Commission (CFEC or Commission) is requesting input from the Alaska Department of Fish and Game (ADFG) regarding the optimum number of limited entry permits in the Kodiak food and bait herring fishery. There are currently nine individual limited entry permits that CFEC issues for the Kodiak food and bait herring fishery: five purse seine permits, and four otter trawl permits. Otter trawl permits have not been fished in the Kodiak food and bait herring fishery since 1997.

CFEC has a statutory obligation to define the optimum range of permits in each limited entry fishery, and typically conducts such an optimum numbers study when petitioned by the public. CFEC determines the optimum range of permits based on the following three standards:

Sec. 16.43.290. Optimum number of entry permits.

Following the issuance of entry permits under AS 16.43.270, the commission shall establish the optimum number of entry permits for each fishery based upon a reasonable balance of the following general standards:

(1) the number of entry permits sufficient to maintain an economically healthy fishery that will result in a reasonable average rate of economic return to the fishermen participating in that fishery, considering time fished and necessary investments in vessels and gear;
(2) the number of entry permits necessary to harvest the allowable commercial take of the fishery resource during all years in an orderly, efficient manner, and consistent with sound fishery management techniques;
(3) the number of entry permits sufficient to avoid serious economic hardship to those currently engaged in the fishery, considering other economic opportunities available to them.

CFEC will answer the first and third standards with a detailed analysis by looking at historical gross earnings in the fishery, the costs associated with participating in seine fisheries around Kodiak, and the median income for a household in the Kodiak area.

ADFG management and research biologists are the individuals most capable of assessing standard two, the optimum number of permits required to harvest the available resource in a sustainable and orderly manner. CFEC is requesting input from ADFG on the following questions:

1. In 2022, the GHL for the Kodiak herring food and bait fishery was 760 tons, which is the largest GHL since 2001. What is the **minimum** number of **seine** permits that would be needed to harvest a GHL of 760 tons for the herring food and bait fishery in an orderly manner, assuming that only seine permits participate.
    a. CFEC currently issues four otter trawl permits for vessels that range in length from under 60 feet, up to 75 feet. If all four otter trawl permits were to take part in the fishery, how does the answer to the above question change?
2. In 2018, the GHL for the Kodiak herring food and bait fishery was 91 tons, which is the lowest GHL since 2001. What is the **maximum** number of **seine** permits that could be fished in order to harvest a GHL of 91 tons for the herring food and bait fishery in an orderly manner?
    a. Given the harvest capacity of otter trawlers, CFEC assumes that 91 tons is too low of a GHL to allow any fishery if otter trawlers intend to participate in harvest activities.

In addition, CFEC requests that ADFG entertain a hypothetical scenario and answer the following two questions. At the recent Kodiak board of fish meeting there was a proposal that sought to allow some portion of the sac roe GHL to be harvested as food and bait. As you may know, the price for herring food and bait is significantly higher than the price for herring sac roe. If permit holders were allowed to choose between harvesting sac roe or harvesting food and bait, they would likely choose to harvest the more valuable resource. With this in mind, CFEC poses the following two additional questions to the department:

1. In 2018, the herring GHL was 1,276 tons for both herring fisheries combined. What is the **maximum** number of **seine** permits that could be fished in order to harvest a GHL of 1,276 tons in an orderly manner if we assume that the four otter trawl permits are participating?
    a. In addition to that question, we ask what is the maximum number of seine permits that could be fished in order to harvest that GHL if the four trawl permits were converted to seine permits?
2. In 2022, the herring GHL was 8,835 tons for both herring fisheries combined. What is the **minimum** number of **seine** permits that would be needed in order to harvest a GHL of 8,835 tons in an orderly manner if we assume that the four otter trawl permits are participating?
    a. And again, we ask what is the minimum number of seine permits that could fish in this scenario if the four trawl permits were converted to seine permits?

When answering the above questions, please keep in mind the following, along with any other considerations that ADFG deems pertinent:

Kodiak Herring Food and Bait Optimum Numbers Study

- Stock sizes,
- Sustainable yield,
- Any management concerns,
- Any conservation concerns,
- Prosecution of an orderly fishery,
- Product quality and marketability,
- Costs of management and research to the department.

We sincerely appreciate your assistance in this research. If you have any questions regarding this request, please contact Reid Johnson, Research Section Leader, 907-717-6512, reid.johnson@alaska.gov.

Cc: Sam Rabung, Director, Division of Commercial Fisheries
Nick Sagalkin, Regional Supervisor, Westward Region
James Jackson, Commercial Management Biologist, Kodiak

Appendix E: ADFG Response to Request for Management Optimum Numbers

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Fish and Game

Division of Commercial Fisheries
Kodiak Office

351 Research Ct.
Kodiak, Alaska 99615
Main: 907.486.1825
Fax: 907.486-1841

Date: June 3, 2024

To: Glenn Haight, Chair/Commissioner

From: James Jackson,
Kodiak Commercial Salmon and Herring Area
Management Biologist
Alaska Department of Fish and Game, Kodiak, Alaska

Kodiak Food and Bait Herring Fishery:

The Commercial Fisheries Entry Commission (CFEC) has requested input from the Alaska Department of Fish and Game (department) regarding the optimum number of limited entry permits in the Kodiak food and bait herring fishery. The CFEC has given the department a series of hypothetical questions based on the maximum and minimum number of participants that could take place in that hypothetical fishery in an orderly and sustainable manner. Some of the questions are asked within the current regulatory framework of the Kodiak food and bait herring fishery. However, many of the questions would require Alaska Board of Fisheries (board) regulatory action.

There are many ways to restrict the harvest in fisheries other than limiting the entry of participants. Most of this is done through regulatory actions taken by the board. Examples of these regulations include gear restrictions, time and area restrictions, and gear allocations. Depending on the regulatory actions taken to limit the harvest in each fishery, the optimum number of limited entry permits may be very different.

Background

The current allocation for the Kodiak food and bait herring fishery Guideline Harvest Levels (GHLs) are calculated as 10% of the previous season's Kodiak sac roe herring GHL in short tons. However, the food and bait fishery is not prosecuted as an aggregate. Instead, district GHLs are established based on a 10% of the previous sac roe seasons district GHL. (5AAC 27.535(b)(c)). For example, if the prior season's sac roe herring GHL for the Uganik District was 2,200 tons, the Uganik District food and bait GHL would be 220 tons. Districts with smaller sac roe GHLs are often excluded from the food and bait fishery to prevent overharvest.

The 10-year average (2013 – 2024) Kodiak sac roe herring GHL is approximately 4,700 tons, with a low of 1,185 tons in 2018 and a high of 8,650 tons in 2023. The 10-year average Kodiak food and bait GHL is approximately 400 tons with a low of 91 tons in 2018 and a high of 815 tons in 2023.

With little to no funding for "on-site" management, past Kodiak food and bait fisheries were difficult to prosecute and the harvest of food and bait herring in the Kodiak Area grossly exceeded individual district GHLs. The CFEC has limited the entry of Kodiak food and bait herring permits to five seine/gillnet permits and 4 otter trawl permits.

Due to the difficulty in prosecuting a sustainable fishery, since the 2001, the food and bait fishery has only been allowed if all Kodiak food and bait herring CFEC permit holders agreed to form a combine and allow 1 purse seine vessel to participate, excluding trawl vessels from participating.

Looking at the past 30 purse seine vessels that have made Kodiak sac roe herring deliveries, the median capacity for a Kodiak sac roe seine vessel is approximately 35 tons, with a broad range between a low of 17 tons to a high of more than 100 tons. It is difficult to come up with an average capacity for otter trawl permits because none have made deliveries since 1997. Given the current vessels size restrictions for Kodiak food and bait trawlers (20 AAC 05.823(u)), it is likely only very small trawl vessels and larger 58-foot limit seine vessels would be able to utilize trawl gear. Based on this, the CFEC's assertion that a trawl capacity of approximately 120 tons per vessel is likely accurate.

The CFEC memo does not mention gillnets. Kodiak food and bait seine permits are seine/gillnet permits. The average capacity of a herring gillnet in the Kodiak Area is significantly less than both seine and trawl gear. Looking at past Kodiak sac roe gillnet deliveries since 1985, there is a broad range of delivery amounts. However, almost all gillnet herring deliveries did not exceed 30 tons. Most sac roe gillnet deliveries since 1985 were under one ton, but 44% were in the 1- to 15-ton range.

Kodiak food and bait otter trawl permits are currently only regulated based on vessel size. Kodiak herring purse seine vessels are limited to 58 feet. There are no vessel size restrictions for herring gillnet vessels. In general, Kodiak herring food and bait gear is less restrictive than the Kodiak sac roe herring gear. Kodiak sac roe purse seine permit holders can fish nets up to 18 fathoms deep and 100 fathoms in length. Kodiak food and bait purse seine permit holders can fish nets up to 1,625 meshes deep and 150 fathoms in length. Kodiak sac roe gillnet permit holders can fish nets up to 150 fathoms in length and up to 230 meshes deep. Kodiak food and bait gillnet permit holders can fish 150 fathoms in length nets with no depth restrictions.

Taking this information into account, the department has been tasked with answering the following hypothetical questions from the CFEC.

First CFEC question: *In 2022, the GHL for the Kodiak herring food and bait fishery was 760 tons, which is the largest GHL since 2001. What is the* ***minimum*** *number of seine permits that would be needed to harvest a GHL of 760 tons for the herring food and bait fishery in an orderly manner,* ***assuming that only seine permits participate****.*

This question is based on the existing fish and game regulatory structure of the Kodiak food and bait fishery. However, CFEC was to exclude trawl gear.

Assumptions:

1) The total 2022 Kodiak food and bait GHL was 760 tons.
2) The 2022 food and bait fishery was managed with six different district GHLs.
3) No board changes were made to the allocations between districts.
4) Only seine/gillnet gear can fish in this hypothetical situation, and the 4 trawl permits are excluded.
5) No board changes to the current seine/gillnet gear descriptions. Seine nets are 150 fathoms in length, 1,625 meshed deep; gillnets are 150 fathoms in length, no depth restriction.
6) Tenders are allowed.
7) No board or department changes to fishing times. The fishery opens by EO and remains open until a district GHL is harvested, and the department closes by EO.

Department answer to CFEC question 1: Again, the Kodiak food and bait herring fishery is not prosecuted as an aggregate but is instead broken up into several different district GHLs. For example, in 2022, the Kodiak herring food and bait GHL for the West Afognak District was 100 tons, the Eastside District was 280 tons, the South Afognak District was 40 tons, the Uganik District was 220 tons, the Alitak District was 40 tons, and the Uyak District was 80 tons.

Even if only seine permits were allowed to fish, the potential for overharvest in districts with smaller GHLs would be high given the lack of on-site management, particularly with some of the larger seine vessels with a capacity of 100 tons. Assuming a median purse seine vessel capacity of 35 tons, the **minimum number** of seine permits needed to not overharvest in smaller GHL districts in an orderly and sustainable fashion is **one seine vessel**.

More seine/gillnet vessels could be allowed in the future if board actions were taken to limit the harvest in districts with smaller GHLs. Changes in net sizes or allocating the smaller GHL districts as gillnet only could slow the pace of the fishery and allow for more vessels.

First CFEC question part (a): *CFEC currently issues four otter trawl permits for vessels that range in length from under 60 feet up to 75 feet. If all four otter trawl permits were to take part in the fishery, how does the answer to the above question change?*

This question is based on the existing fish and game regulatory structure of the Kodiak food and bait fishery and trawl gear was allowed to fish.

Assumptions:

1) The total 2022 Kodiak food and bait GHL was 760 tons.
2) The 2022 food and bait fishery was managed with six different district GHLs.
3) No board changes were made to the allocations between districts.
4) Both seine/gillnet and trawl gear can fish in this hypothetical situation.
5) No board changes to the current seine/gillnet gear descriptions. Seine nets are 150 fathoms in length, 1,625 meshed deep; gillnets are 150 fathoms in length, no depth restriction.
6) Tenders are allowed.
7) No board or department changes to fishing times. The fishery opens by EO and remains open until a district GHL is harvested, and the department closes by EO.

Department answer to CFEC question 1(a): Again, in this hypothetical example, the district with the smallest GHL would have been the South Afognak District at 40 tons. If all trawl permits were allowed to fish, assuming a trawl vessel capacity of 120 tons, the potential for overharvest in districts with smaller GHLs would be too great. The department would likely close the food and bait fishery due to conservation concerns.

Second CFEC question: *In 2018, the GHL for the Kodiak herring food and bait fishery was 91 tons, which is the lowest GHL since 2001. What is the* ***maximum*** *number of seine permits that could be fished in order to harvest a GHL of 91 tons for the herring food and bait fishery in an orderly manner? Given the harvest capacity of otter trawlers, CFEC assumes that 91 tons is too low of a GHL to allow any fishery if otter trawlers intend to participate in harvest activities.*

This question is based on the existing fish and game regulatory structure of the Kodiak food and bait fishery.

Assumptions:

1) The total 2018 Kodiak food and bait GHL was 91 tons.
2) The 2018 food and bait fishery was managed with three different district GHLs.
3) No board changes were made to the allocations between districts.
4) Only seine/gillnet gear can fish in this hypothetical situation, and the 4 trawl permits are excluded.
5) No board changes to the current seine/gillnet gear descriptions. Seine nets are 150 fathoms in length, 1,625 meshed deep; gillnets are 150 fathoms in length, no depth restriction.
6) Tenders are allowed.
7) No board or department changes to fishing times. The fishery opens by EO and remains open until a district GHL is harvested, and the department closes by EO.

Department answer to CFEC question 2: Using 2018 as an example, the smallest Kodiak food and bait herring district GHL was the South Afognak District at 19 tons. Assuming an average purse seine vessel capacity of 35 tons, the **maximum number** of seine vessels that would be needed to harvest 19 tons is **one seine vessel**.

Third CFEC question: *In 2018, the herring GHL was 1,276 tons for both herring fisheries combined. What is the **maximum** number of seine permits that could be fished in order to harvest a GHL of 1,276 tons in an orderly manner if we assume that the four otter trawl permits are participating*

This question is not based on the existing fish and game regulatory structure of the Kodiak food and bait fishery. This hypothetical example assumes that the board has made significant changes to the existing Kodiak Area herring fisheries and has allocated all the Kodiak herring to be caught in the food and bait fishery.

Assumptions:

1) The total 2018 Kodiak food and bait GHL would have been 1,276 tons.
2) The 2018 food and bait fishery would have been managed with six different district GHLs.
3) No board changes were made to the allocations between districts.
4) Both seine/gillnet gear and trawl gear can fish in this hypothetical situation.
5) No board changes to the current seine/gillnet gear descriptions. Seine nets are 150 fathoms in length, 1,625 meshed deep; gillnets are 150 fathoms in length, no depth restriction.
6) Tenders are allowed.
7) No board or department changes to fishing times. The fishery opens by EO and remains open until a district GHL is harvested, and the department closes by EO.

Department answer to CFEC question 3:

Using 2018 as an example, if we combined the Kodiak Area food and bait and sac roe GHLs by district, the smallest Kodiak food and bait herring district GHL would have been the South Afognak District at 201 tons. Assuming an otter trawl vessel capacity of 120 tons, if all four permits were allowed to fish, the **maximum number** of seine vessels that could be fished to harvest 201 tons in an orderly and sustainable fashion is **zero seine vessels**. For reasons of sustainability, the department would also be hesitant to allow 4 otter trawl permits to fish in districts with small GHL.

The department is neutral on any allocative proposals brought before the board. However, allowing commercial fishermen to harvest all Kodiak Area herring during the food and bait timeframe would likely have unforeseen consequences regarding the potential mixing of Kodiak Area and non-Kodiak Area herring stocks during the fall and winter months. The board could also take further regulatory action to limit the pace of the fishery and allow more permits to fish.

Third CFEC question part (a): *Additionally, we ask what is the* ***maximum*** *number of seine permits that could be fished in order to harvest that GHL if the four trawl permits were converted to seine permits?*

Again, this question is not based on the existing fish and game regulatory structure of the Kodiak food and bait fishery. This hypothetical example assumes that the board has allocated all the Kodiak herring to be caught in the food and bait fishery. This question also assumes that the CFEC has converted the 4 trawl permits to seine/gillnet permits.

Assumptions:

1) The total 2018 Kodiak food and bait GHL would have been 1,276 tons.
2) The 2018 food and bait fishery would have been managed with six different district GHLs.
3) No board changes were made to the allocations between districts.
4) Only seine/gillnet gear can fish in this hypothetical situation.
5) No board changes to the current seine/gillnet gear descriptions. Seine nets are 150 fathoms in length, 1,625 meshed deep; gillnets are 150 fathoms in length, no depth restriction.
6) Tenders are allowed.
7) No board or department changes to fishing times. The fishery opens by EO and remains open until a district GHL is harvested, and the department closes by EO.

Department answer to CFEC question 3(a):

Using 2018 as an example, if we combined the Kodiak Area food and bait and sac roe GHLs by district, the smallest Kodiak food and bait herring district GHL would have been the South Afognak Section at 201 tons. Assuming a median purse seine vessel capacity of 35 tons, the **maximum number** of seine vessels that could fish in an orderly and sustainable fashion to harvest 201 tons is approximately **six** vessels.

Again, more vessels could be allowed in the future if the board took actions to limit harvest in districts with smaller GHL. Also allowing commercial fishermen to harvest all Kodiak Area herring during the food and bait timeframe would likely have previously mentioned unforeseen consequences.

Fourth CFEC question**:** *In 2022, the herring GHL was 8,835 tons for both herring fisheries combined. What is the* ***minimum*** *number of seine permits that would be needed in order to harvest a GHL of 8,835 tons in an orderly manner if we assume that the four otter trawl permits are participating?*

This question is not based on the existing fish and game regulatory structure of the Kodiak food and bait fishery. This hypothetical example assumes that the board has allocated all the Kodiak herring to be caught in the food and bait fishery.

Assumptions:

1) The total 2022 Kodiak food and bait GHL would have been 8,835 tons.
2) The 2022 food and bait fishery would have been managed with at least six different district GHLs.
3) No board changes were made to the allocations between districts.
4) Both seine/gillnet gear and trawl gear can fish in this hypothetical situation.
5) No board changes to the current seine/gillnet gear descriptions. Seine nets are 150 fathoms in length, 1,625 meshed deep; gillnets are 150 fathoms in length, no depth restriction.
6) Tenders are allowed.
7) No board or department changes to fishing times. The fishery opens by EO and remains open until a district GHL is harvested, and the department closes by EO.

Department answer to CFEC question 4:
This hypothetical question could only take place if the board were to use its regulatory authority to reallocate all the herring harvested in the Kodiak area to just the food and bait fishery. Using 2022 as an example, if we combined the Kodiak Area food and bait and sac roe GHLs by district, the smallest Kodiak food and bait herring district GHL would have been the South Afognak District at 440 tons. Assuming a median purse seine vessel capacity of 35 tons, and an otter trawl capacity of 120 tons, the **minimum** number of seine vessels that would be needed to harvest 440 tons in an orderly and sustainable fashion is **zero seine vessels**. The potential for overharvest with the 4 trawl vessel permits would also be high. However, four trawl vessels would also likely have a challenging time harvesting the total food and bait GHL of 8,835 tons in an orderly fashion.

Again, more vessels could be allowed in the future if the board took actions to limit harvest in districts with smaller GHLs. Also allowing commercial fishermen to harvest all Kodiak Area herring during the food and bait timeframe would likely have previously mentioned unforeseen consequences.

Fourth CFEC question part (a)*: *And again, we ask what is the minimum number of seine permits that could fish in this scenario if the four trawl permits were converted to seine permits?

This question is not based on the existing fish and game regulatory structure of the Kodiak food and bait fishery. This hypothetical example assumes that the board has allocated all the Kodiak herring to be caught in the food and bait fishery. This example also assumes the CFEC converted all 4 trawl permits to seine permits.

Assumptions:
1) The total 2022 Kodiak food and bait GHL would have been 8,835 tons.
2) The 2022 food and bait fishery would have been managed with at least six different district GHL's.
3) No board changes were made to the allocations between districts.
4) Only seine/gillnet gear can fish in this hypothetical situation.
5) No board changes to the current seine/gillnet gear descriptions. Seine nets are 150 fathoms in length, 1,625 meshed deep; gillnets are 150 fathoms in length, no depth restriction.
6) Tenders are allowed.
7) No board or department changes to fishing times. The fishery opens by EO and remains open until a district GHL is harvested and the department closes by EO.

Department answer to CFEC question 4(a):
Using 2023 as an example, if we combined the Kodiak Area food and bait and sac roe GHLs by district, the smallest Kodiak food and bait herring district GHL would have been the South Afognak District at 440 tons. Assuming a median purse seine vessel capacity of 35 tons, the **minimum** number of seine vessels that would be needed to harvest 440 tons in an orderly and sustainable fashion is **1 seine vessel**. However, 1 seine vessel would not be sufficient to harvest the hypothetical total Kodiak Area food and bait GHL of 8,835 tons in an orderly fashion, and some regulatory action would be needed to prosecute the fishery.

Conclusion:
It is important to point out that all these questions do not consider future board regulatory actions that could be used to control the pace of the fishery, including different net sizes, daily fishing times, gear restrictions, or future allocations. For example, Kodiak sac roe herring nets are significantly smaller than food and bait herring nets. Also, none of these scenarios consider whether gillnet vessels are allowed to fish. For example, districts with smaller food and bait GHLs could be made gillnet only, allowing for many more vessels to fish districts with significantly larger GHLs.

The sac roe fishery has been in place for 40 plus years and in that time, the department has developed a harvest strategy that allowed them to manage the fishery regardless of the number of vessels. The sac roe fishery is a large volume, allocative, actively managed fishery that can accommodate a large number of permits, whereas the Kodiak food and bait fishery is a small volume, low-department cost, passively managed fishery that can only accommodate a small number of permits.

If the food and bait fishery were to change, there would need to be necessary changes made by both CFEC and the board regulations based on input from the department to enable managers to successfully manage an entirely different fishery. This would be based on department resources, biological differences in population dynamics, allocations between gear groups based on harvest ability, and many other factors. There are numerous other assumptions that could be made, however for the sake of brevity, the department limited assumptions.

Sincerely,

James Jackson
Kodiak Salmon and Herring
Area Management Biologist
1-907-486-1808

Cc: Doug Vincent-Lang, Commissioner, Department of Fish and Game
Sam Rabung, Director, Division of Commercial Fisheries
Nick Sagalkin, Regional Supervisor, Westward Region