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ALASKA SEAFOOD SNAPSHOT

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Alaska Seafood Snapshot

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Executive Summary

Beset by declines in Alaska's commercial fisheries revenues in 2023 and increases in harvesting and processing costs in 2022 and 2023, the Alaska fishing industry asked NOAA Fisheries to undertake an independent quick-turnaround "Snapshot" report summarizing the status of the economic and social conditions within the Alaska seafood industry.

The industry faced large increases in many categories of fishing and processing costs over those 2 years, including labor rates (wages), energy prices, and interest rates as well as decreases in sale prices for every major species group in 2023. Analysts compiled an Ex-Vessel Margin Index, a measure of profitability for commercial landings, defined as a Revenue Index divided by a Cost Index where both are normalized to 2011 prices. This index suggests profitability declined by 50 percent from 2021 to 2023. Ex-vessel revenues were fairly stable from 2021 to 2022 but dropped 32 percent ($617 million) from 2022 to 2023. Similarly, first-wholesale values dropped by $1.2 billion (26 percent) from 2022 to 2023 for a total direct loss of $1.8 billion.[3] This shock to the Alaska seafood industry resulted in a loss of more than 38,000 fishing and non-fishing jobs in the United States and a loss of $4.3 billion in total U.S. output (the total dollar value of all goods and services produced) and a total decrease of $269 million in state and local tax revenues. These impacts are being felt not only in Alaska, but in Washington, Oregon, California, and the rest of the country, as the Alaska seafood industry imports approximately one-third of its inputs from other regions.

For many Alaskans the decline of their seafood industry affects their pocketbooks, presents food security concerns, and impacts their way of life, sense of place, community, and identity. In the face of evolving climate-driven impacts to ecosystems and fisheries in the region, these recent market disruptions undermine the capacity of all segments of the seafood industry and associated fishing communities to be resilient and survive in fisheries now and in the future.

[1] All 2023 revenue data are considered preliminary. Final calendar year 2023 revenues for federally managed groundfish and crab will be available in November 2024 in the Groundfish Economic SAFE and January 2025 in the BSAI Crab Economic SAFE report, respectively.

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[3] First-wholesale is a term that refers to the first sale to the wholesale market after primary processing (which happens in AK). Many products undergo secondary (or more) processing throughout the supply chain.

1. Introduction

This report provides a snapshot of the current state of the Alaska seafood industry, which has undergone tremendous changes in the past several years. The report is based on ex-vessel landings and ex-vessel revenues, as well as production of processed products and resulting first wholesale revenue information through 2022.

While landings estimates are available for 2023, we nowcast ex-vessel revenue data for 2023 using statistical methods, and we use preliminary first-wholesale prices and revenue data for 2023. After an initial review of production and cost data, we talked to a cross-section of participants in the Alaska seafood industry to better understand the challenges facing the sector (including fishermen, processors, associations, and state agencies). In addition, we talked to people in the communities who depend upon the seafood industry to get preliminary indications of the magnitude of the effect the decline in seafood revenues is having on their community. We also gathered and reviewed trade press articles and recent reports about Alaska and global seafood, a list of which appears in section A.8.

This report focuses on the commercial, for-profit, seafood industry in Alaska - from small individual owner-operated fishing enterprises to large vertically integrated catcher-processing companies. Subsistence and recreational fishing, while critical to Alaskans, the Alaska economy, and Alaska food security, are not covered in this snapshot report. The recreational sector, and subsistence fisheries are important sectors of the Alaska fishing industry and could be considered in future reports as warranted. For this report, data limitations for both subsistence fishing and the recreational sectors are comparatively more limited or lagged and therefore precluded the creation of comparable time series through 2023 at the time the report was written.

a. Social and economic importance of seafood in Alaska

The seafood industry is a major private sector employer in Alaska (McKinley 2024). For many coastal communities in the state, fisheries are both the primary economic engine and main cultural driver. Alaska Natives have fished for thousands of years in Alaska, developing cultural systems deeply interconnected with fisheries for social cohesion, identity, cross-generational learning, and a strong subsistence economy. Commercial fisheries have flourished in Alaska for generations, shaping social structures, cultural identity, and a robust market economy.[4] The decline of fisheries in the region threatens a way of life, sense of place, community, and identity. Consideration of these connections is critical to understanding the potential implications of the recent challenges facing these communities, which could have cascading

[4] Profiles of 192 fishing dependent communities in Alaska can be found here: https://reports.psmfc.org/akfin/f?p=501:2003::INITIAL.

effects on fisheries participation, community populations and revenues, as well as compounding impacts on various dimensions of well-being including mental and physical health, equity, social connections, spirituality and culture, knowledge, and skills.[5]

b. Recent challenges faced by the Alaska seafood industry

Lower Seafood Prices

- Since several Russian fisheries have received conditional[6] Marine Stewardship Council (MSC) certification, there is a lack of market differentiation between sustainably harvested and regulated Alaska seafood and products produced in Russia that do not adhere to the same standards (Rosen 2024c, Seaman 2024).
- Russian walleye pollock is still able to be called "Alaska pollock" in most international markets, further confusing consumers about the benefits of truly Alaskan pollock (Rosen 2024c).
- During 2022 and 2023 retailers gradually sold a large quantity of seafood held in cold storage that had been purchased at relatively high prices, which was different from how retailers handled the seasonal influx of seafood products in the past. Historically, retailers would lower prices to clear inventory, but media reports and conversations with the AK seafood industry indicated that in 2022-2023 retailers transitioned to keeping their new purchases of wholesale supply lower and slowly moved high priced inventory out of cold storage. This practice gradually lowered the quantity of seafood in the market and kept retail prices high, thereby maximizing profit margins for the retailers. In 2023-2024, with the decline in purchases of most seafood, there is lower quantity demand from retailers for new products from producers, processors, and wholesalers. Consequently, prices paid to producers have fallen. Seafood prices have softened somewhat in 2024, but not by enough to entice some consumers back to

[5] Community Social Vulnerability Indices for Alaska and other U.S. communities are described in more detail here: https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-coastal-communities

[6] The Marine Stewardship Council (MSC) may grant a fishery conditional certification if it scores between 60 and 79 on one or more performance indicators (PIs) during an assessment. This means that the fishery must take action to improve its performance and score at least 80 on the relevant PIs in order to receive full certification. The fishery usually has five years or less to make these improvements. https://www.msc.org/for-business/fisheries/fishery-certification-guide

purchasing the volumes of seafood they bought in 2020-2021 (Bristol Bay fishers 2023, Bristol bay salmon 2024, McKinley 2024, Rosen 2024b).

Residual COVID Impacts

- The COVID-19 pandemic in 2020 brought unprecedented and destabilizing changes to the seafood industry and fishing communities that led to substantial revenue losses, increased costs, and decreased participation. Fishermen and processors faced tremendous logistical hurdles and increased costs in recruiting workers, maintaining health standards, and supplying their operations. For example, processors had to purchase large quantities of often scarce personal protective equipment for their workers along with having to quarantine workers for extended periods before they could work in the processing plants (Earl 2020, McKinley Research 2021, NOAA Fisheries 2021).
- During the initial COVID-related supply and market disruptions, consumers, fearful of contacting COVID, stopped going out to eat, forcing some restaurants to close or curtail operations. Instead, consumers cooked more food, including seafood, at home leading to increased supermarket demand for some Alaska species like pollock and crab (sustained in part by tax relief and economic impact payments). Prices for seafood species in demand rose (e.g. shelf stable and frozen products and fresh Atlantic salmon). Supermarkets and seafood suppliers purchased large amounts of frozen seafood and put it in cold storage. However, the pandemic also led to sharply increased input costs (labor, materials/equipment, and energy) and to consumer price inflation. Higher demand for seafood, higher input costs, as well as wholesalers and supermarkets holding large inventories of relatively high priced products led to high retail seafood prices. By 2022, consumers, hit with inflation and higher consumer prices (and wages not keeping up especially after the federal wage subsidy ended) lowered their purchases of seafood and traded down to cheaper proteins like chicken. Supermarkets and restaurant seafood suppliers, holding large inventories of seafood for which they paid high prices, were reluctant to unload that inventory at low prices, as well as to add to inventory. All of these factors contributed to lower prices for seafood paid to producers (fishermen and harvesters) (McKinley 2021, NOAA Fisheries 2021).

Trade and Tariffs

- National and international market forces have resulted in high inventories and low priced seafood throughout the global supply chain. Factors influencing this include high levels of Russian exports, particularly of pollock, cod, salmon, and crab, each of which directly compete with Alaska seafood, exerting downward pressure on prices received by Alaska producers (Ainsworth 2024, Garden 2024b, McKinley 2024). Trade data indicate a significant increase in pollock, cod, and salmon exports from Russia in 2022,

just prior to the issuance of Executive Order 14068 banning the importation of Russian seafood on 3/11/2022. This could have increased whitefish and salmon inventories putting downward pressure on these prices. The pulse in Russian seafood exports did not carry through into 2023 but could have contributed to inventory challenges beyond 2022. Large quantities of Russian king and snow crab were also imported prior to this ban, both falling to zero in 2023 (Garber-Yonts, et al. 2024).

- A strengthening of the U.S. dollar (particularly compared to the Japanese yen) and a relative weakening of the Chinese yuan-Russian ruble and Japanese yen-Russian ruble have made Russian imported seafood into China and Japan substantially cheaper than U.S. seafood (McKinley 2024). China and Japan are the second and third largest export destinations for Alaska seafood products (Canada is first). They comprised 18% and 13% of total direct export value share over 2019-2023.[7]
- Tariff and trade issues over the past several years have severely impacted the whitefish markets that many businesses in the region rely upon. Seafood tariff asymmetries still exist with several important trading partners including China, the EU, and Japan; our trading partners have duty-free access to US markets but U.S. producers face tariffs of between 1 and 30 percent in these countries (Evans 2023, McKinley 2024).
- Global markets are important to the Alaska seafood industry as upwards of 70 percent of Alaska seafood products are exported although the percentage varies significantly by species. Non-tariff barriers and import quotas limit market access for U.S. seafood producers in large seafood consuming nations including China, the EU, and Japan.
- Russia has been subsidizing the modernization of their fishing fleet and processing operations and are able to produce pollock and salmon at lower costs than U.S. producers due to these investments as well as lower wages and other inputs and less rigorous environmental standards (Blagov 2024, Chase 2024).
- Labor rates in China and elsewhere in Asia are substantially lower than wages paid to seafood processing workers in the United States, resulting in lower production costs of processing seafood in those countries (Godfrey 2020, ILO 2022).

Fisheries Disasters

- Commercial and recreational fishermen and businesses, subsistence fishermen, and processors can apply to the federal government for financial relief from fishery disasters

[7] Other countries, including Japan, receive Alaska harvested product indirectly after secondary processing in a third country (such as China). However the lack of comprehensive supply chain traceability inhibits the calculation of value share based on final demand. Furthermore, Alaska harvested seafood export may to a lesser extent be routed through other customs districts such as Washington state.

through the Fishery Resource Disaster Determination Process.[8] An eligible entity (e.g., state governor, Tribal leader, etc.) needs to make a request to the Secretary of Commerce for a disaster determination that, if approved, means the entity is eligible to receive fishery disaster assistance. Since there is no standing fund for fisheries disaster assistance, Congress must appropriate funds, and the Secretary allocate and distribute those funds, before any payments to impacted fishery participants or other activities can happen. In the past few years, the Secretary of Commerce has provided approximately $385 million in disaster relief funds for various Alaska crab, salmon, and cod fisheries, with additional disaster requests still pending determinations and funding allocations.[9] The Fishery Resource Disasters Improvement Act includes several statutory changes to NOAA Fisheries Fishery Resource Disaster Program, such as specific timelines and information requirements for fishery resource disaster requests, determinations, and assistance. It is anticipated these statutory changes will improve the timeliness of the fisheries disaster process, and when appropriated funds are available, get funding to impacted fishery participants more quickly. Revenue declines in state and federal fisheries with no large decrease in stock biomass or loss of access may not meet the definition of a fishery resource disaster, as market conditions are not allowable causes for relief (MSA 2022, NOAA Fisheries 2023a, Rosen 2024d).

Lack of Revenue Insurance

- Unlike the agricultural sector, there are no federally sponsored revenue insurance mechanisms for the fishery sector that might help mitigate against unexpected revenue declines as a result of market collapses or environmental challenges.

Processor Employment and Plant Closures

- Seafood processing jobs have generally declined in Alaska over the past decade. For example, the seasonal July peak in 2023 was almost 3,000 jobs less than the 2015 summer peak of 21,300 jobs. Averaging processing job numbers over the full year gives a better sense of the activity across all types of processing, from salmon, groundfish, and halibut to herring and shellfish. Using that measure, average annual processing employment reached its decadal high in 2014 at more than 10,600 jobs (AKDOLWD 2024, Dobreth 2024, Rosen 2024b).
- Processing jobs provide employment opportunities in many remote Alaskan communities where employment is scarce (Venua 2023). Without reliable employment, increased out-migration can threaten to disrupt rural community structures and well-being (ibid.).
- Alaska seafood processing worker wages increased substantially in 2022 and 2023 as indicated by the Quarterly Census of Employment and Wages (QCEW). This may be

[8] https://www.fisheries.noaa.gov/national/resources-fishing/frequent-questions-fishery-resource-disaster-assistance

[9] https://www.fisheries.noaa.gov/national/funding-financial-services/fishery-resource-disaster-determinations.

beneficial from the perspective of more wages being spent in the U.S., although higher overall labor costs place strains on the processing industry.

- In 2024, multiple processors announced seasonal or permanent plant closures across Alaskan fishing communities. This included the sale of three of Trident's largest processing facilities (Ketchikan, Petersburg, and False Pass), and an uncertain future for their Kodiak plant and two other facilities (South Naknek Diamond NN Cannery and Chignik) not operating in 2024 (White 2023, 2024b, 2024c, 2024d, 2024e).
- Peter Pan, a seafood processing company, closed its operations indefinitely, with multiple sales and leases of its facilities and the closure of its processor in King Cove (Bauman 2024).
- OBI Seafoods, a seafood processing company, announced the 2024 closure of its plant in Larsen Bay and that it would not take landings from the Alitak setnet fleet for the season (Parker 2024).
- The ongoing closure of the snow crab fishery has resulted in the closure of the only processing plant in St. Paul which has been particularly devastating for the isolated Bering Sea community. It has lost 60% of its municipal tax revenue and community budget as a result of the closure and the community declared a cultural, economic, and social emergency (Nelson 2022).
- Other smaller plants closed as well, including Whittier Seafoods and Ekuk Fisheries (which sold its operation in Bristol Bay) (Cherry 2024, White 2024a).

Cumulative Impacts

- The compounding impacts of these multiple changes have been described by some fishermen in the region as "death by a thousand cuts". The ultimate impact of these multiple factors is a severe decline in commercial fishing participation in the region for the past decade (Figure 3, Abelman et al. 2023), with impacts extending across local economies, lost employment and learning opportunities for crewmembers, and degraded connections to fisheries and the marine ecosystem more broadly (Szymkowiak and Steinkruger, in review).
- In 2023 many fishermen in Alaska faced steep declines in dockside prices (Figures 1, 3, and 4), shortened fishing seasons because processors were not accepting fish at the end of the season, and some processors were not immediately compensating fishermen for landed fish. The total ex-vessel revenue losses in 2023 (estimated to be $617 million) left many with little or no profits after accounting for various operating costs. Fishermen's capacity to endure these types of losses is impeded by increased financing costs (via higher interest rates) on fishing debt resulting from high permit, quota, boat, and gear costs, compounded by a decade of declining revenues associated with decreasing catch limits driven by abrupt and gradual ecological changes (described in more detail below), increased costs from nationwide inflation, and decreases in prices for many species (Szymkowiak and Steinkruger, in review).
- The closures, sales, and leases of processing facilities in 2024 left many fishermen, processing workers, and communities scrambling. Numerous fishermen across the region had to attempt to find new buyers for their fish, causing tremendous distress. Plant closures displaced processing workers and left residents of fishing communities

unemployed or underemployed (Nelson 2022; Venua 2023; White 2023, 2024b, 2024c, 2024d, 2024e).

- Communities with plant closures face substantial losses in tax revenues from processing and local spending, creating uncertainty in community budgets and spending. For example, in the community of King Cove, the closure of the Peter Pan plant has been devastating, with an estimated loss of 70 percent of its community revenues compounded by losing momentum on multiple community projects that relied on the processing facility to purchase hydroelectric power, water, and solid waste disposal (Herz 2024; White 2024).
- Some communities are attempting to mediate these losses by increasing various taxes and electricity rates for residents, further exacerbating the reduction in ex-vessel operating margins described in section 2.e (Nelson 2022).
- Community businesses that support the fishing industry and rely on fishermen spending are struggling for survival (Nelson 2022; Venua 2023; White 2023, 2024b, 2024c, 2024d, 2024e).

c. Methods

Estimating Revenues

This section describes the approach to nowcast 2023 ex-vessel revenues while prior year revenues, prices, and landings are known without error.[10] While landings are known in near real time, processed products (first wholesale) produced by processors are sold throughout the year, and often into the following year, and several species (pollock, crab, and salmon) provide substantial post-season adjustments to harvesters (ex-vessel) based on the quality and resulting price received from their harvest. This necessitates the need to delay reporting final ex-vessel and first-wholesale prices until substantially after the landing of the species at the processor. Thus while 2023 (and now partial 2024) landings are known, prices and revenues are still preliminary and 2023 ex-vessel prices and revenues are nowcasted using the methods described below. We utilize preliminary 2023 first-wholesale prices due to the limited time in which we conducted the analysis.

There are three sources of ex-vessel price data in the North Pacific: 1) Alaska Department of Fish and Game (ADF&G) in-season fish ticket (FT) prices from the time of landing; 2) Commercial Operators Annual Report (COAR) ex-vessel prices which include postseason bonuses; and 3) Alaska Commercial Fisheries Entry Commission (CFEC) ex-vessel prices, which

[10] The term "ex-vessel", sometimes called dockside, generally refers to the first sale of a species off the harvesting vessel, most commonly in an unprocessed (raw) form (referred to as "round weight"). Product recovery rates can be applied to convert round weight of landings to processed product (filets, head and gutted (H&G), meal, etc.) net weight and vice versa.

use the COAR report data to update the prior year's ex-vessel price estimate for the purpose of calculating landings taxes. The CFEC prices generally are not finalized until the fall of the following year. 2023 ex-vessel prices were estimated ("nowcasted") by converting the in-season ADF&G prices to CFEC prices in an effort to provide more real time information to the public.[11] Earlier versions of these nowcasts have been used in the past two Groundfish Economic SAFE reports (Ableman et al. 2023, 2024) and the most recent Crab Economic SAFE report (Garber-Yonts et al. 2024).

Table A2 provides a list of the 61 independent models estimated by species and gear type used in the nowcasting of 2023 ex-vessel prices.[12] These prices are likely to be different from those provided by the State of Alaska and the NOAA Fisheries once the Commercial Operator's Annual Report (COAR) is finalized in the fall of 2024; data updates will be provided by processors as they finalize prices based on 2023 products sold during the late spring and summer of 2024. We then multiply these nowcasted prices by 2023 landings information to generate our estimate of 2023 CFEC ex-vessel revenues (hereafter, 2023 ex-vessel revenues).

The Ex-Vessel Revenue Index is then created from the CFEC ex-vessel revenues in each year divided by the value in 2011, such that the index=1 in 2011.[13] The Ex-Vessel Revenue Index is created separately for different species or regional aggregations including 1) Statewide; 2) BSAI region; 3) GOA region; 4) species group; and 5) species-region group. Similarly, the Output Quantity (lbs) Index is created by dividing the total pounds of commercial seafood landed in a given year divided by the value in 2011 for each species region, and gear type. The Output Price Index is then defined by dividing the Ex-Vessel Revenue Index by the Output Quantity (lbs) Index for each species and gear type combination and represents a weighted index of average seafood prices.

Estimating Costs

As cost data collections do not exist in every state and federal fishery in Alaska, to understand recent trends in input prices we rely on publicly available data sources for several categories of costs known to be important to the seafood industry, including capital (interest rates), labor (wage rates), general (as measured by inflation), and energy (fuel prices). While these will not provide us with estimates of profits gained or lost, we think they approximate the trends in

[11] Specifically, 2023 ex-vessel prices were estimated ("nowcasted") using constrained linear regression with monthly CFEC prices as the true values (dependent variable) and ADF&G in-season prices, preliminary COAR prices, import and export prices, along with month and annual fixed effects as explanatory variables and using the pounds landed to weight observations.

[12] The results of these models will be made available in a future NOAA Fisheries Technical Memorandum.

[13] 2011 was chosen as the base year as it was a period of relative ecological, economic, and policy stability in the system.

costs experienced by the seafood industry in Alaska. Figure A1 displays the input data used to estimate each gear-specific, or processor, Cost Index, based upon different weights across the BAA corporate bond rate (capital costs and investment),[14] labor rates for Seattle construction workers as an opportunity cost wage for the harvesting sector, labor rates for seafood preparers in Alaska for processing wages,[15] the Consumer Price Index for urban Anchorage for general inflationary pressure on input prices,[16] and an index of statewide average #2 diesel prices derived from EFIN (Pacific States Marine Fisheries Commission (PSMFC) Fisheries Economics Data Program; www.psmfc.com/efin/). Table A2 provides the estimated cost shares derived from Economic Data Report (EDR) data, the 10MRSAM regional economic modeling tool,[17] and expert opinion. We are uncertain how well these estimates represent the actual cost structure of these various seafood operations, but we are certain that several costs are missing for which we were unable to find adequate third-party data, including insurance rates (and providers), packaging, and cold storage, each of which have been increasing recently according to our industry sources. The Input Price Index for each gear type is then created as a weighted index of input prices shown in Figure A1 with weights across categories defined by Table A2.[18] The total number of active commercial vessels fishing using each gear type is used as a rough measure of input quantity, and the Input Quantity (vessels) Index is created by dividing each year's value by the number of active vessels using that gear type in 2011.[19] The Ex-vessel Cost Index is then simply the Input Price Index multiplied by the Input Quantity (vessels) Index, such that the Ex-vessel Cost Index=1 in 2011.

Estimating the Ex-vessel Margin Index

[14] Sourced from the St. Louis Federal Reserve Bank, https://fred.stlouisfed.org/series/BAA.

[15] The Residential building construction wage (North American Industry Classification System (NAICS) code 2361) and seafood product preparation and packaging (NAICS code 3117) wage data comes from the Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW), https://data.bls.gov/PDQWeb/en. We use this source rather than H2B wages because this time series is longer. As a robustness check, both were indexed to 2013 (the first year of H2B wage data available) and they both showed similar trends.

[16] Sourced from the St. Louis Federal Reserve Bank, https://fred.stlouisfed.org/series/CUUSA427SA0.

[17] https://nwecon.psmfc.org/ and Seung and Miller 2020. Developing a Multi-Regional Social Accounting Matrix (MRSAM) for Southwest Alaska Fisheries. NOAA Tech Memo NMFS-AFSC-399.

[18] The Alaska harvesting industry is among the most capital intensive in the U.S. as shown by the large return on capital share in Table A2., which also includes the owner/vessel share valued at the opportunity cost of capital, the market interest rate. While we expect borrowed capital to receive a return equal to its opportunity cost, the owner/vessel share is likely to rise/shrink as profits change. Additional information on cost components and profit margins would improve future analyses of the impact of market and environmental changes on the Alaska seafood industry and fishing dependent communities.

[19] This refers to the number of active processors in the case of the Processor Input Price Index.

The Ex-vessel Margin Index is defined as the Ex-vessel Revenue Index divided by the Ex-vessel Cost Index. It is a relative measure of changes in revenues and costs since 2011 and does not directly measure profits or net revenues (shown in Figure 7, described in more detail in section A.4). While these indices have been defined here in aggregate, they are also derived for each species group and shown in Figures A4 to A7. Caution should be taken when interpreting these indices, particularly the fishery specific ones, as the changes in margin are a combination of changes in abundance, effort, input prices, output prices, and landings and sometimes produce somewhat counterintuitive results. For example, Figure A6 shows Gulf of Alaska (GOA) pollock having substantially increased its Ex-vessel Margin Index value since 2017, largely as a result of a declining Cost Index from a 23 percent decrease in active vessels trawling between 2011 (83) and 2023 (64). Concurrently, the metric tons of pollock landed by these vessels have increased by 68 percent while ex-vessel revenues only increased by 5 percent over the same period. Without additional data or models, it is unclear whether this is the result of increased efficiencies and a sign of success or if those exiting vessels are no longer economically viable in this fishery. This highlights the limited insight one can derive from cost indices rather than the actual cost data itself.

We applied the nowcast estimates of changes in ex-vessel and first-wholesale revenues in 2023 derived above (a $1.8 billion reduction) to estimate the change (direct effect or "shock") in total revenues by species group to each of the 10 Borough/Census Areas (BCA; county in most states) or regions (Rest of Alaska, Washington, Oregon, and California, and Rest of U.S.) using the 10 Multi-Regional Social Accounting Matrix (MRSAM) model.[20] We then use these species- and BCA-specific) changes in revenue to estimate changes in economic output and employment for each BCA/region . Section A7 includes a map of the 10 BCAs/regions, the defined BCAs/regions and species groups (Table A3), and a detailed breakdown of the changes in ex-vessel and first wholesale revenues (shocks) for each of the 10 BCAs/regions between 2022 and 2023 used in the MRSAM model (Tables A4 and A5). Seung et al. (2020) and Seung and Miller (2018, 2020) provide a detailed summary of the MRSAM model, BCAs/regions, and assumptions.

[20] There are three different versions of the 10MRSAM model – (i) a gear-based fishery industries version (GB), (ii) a species-based industries version (SB), and (iii) charter-based (CB) model. The first two versions (GB and SB) are intended for analysis of commercial fisheries while the third one (CB) is for analysis of the charter sector. This analysis uses the gear-based fishery industries version of the 10MRSAM which has a total of up to 466 endogenous accounts (or sectors) 34 in the At-sea region + 53 in each of 6 Southwest Alaska (SWAK) BCAs + 38 in each of 3 non-SWAK BCA regions. All three 10MRSAM versions include four overall exogenous accounts [savings-investment, federal government revenue and spending, foreign trade (imports and exports), and trade-balancing financial flows].

2. Alaska seafood in a global market

Most Alaska seafood products are at least in part exported and compete on the global market for seafood products. First-wholesale revenues losses were largely driven by an overall 23% decrease in estimated prices in 2023 (Figure 1). In particular, key species in Alaska including salmon, pollock, and cod saw significant decreases in 2023 prices relative to 2022 prices. Some of the price changes are transitory in nature–for example, high inventories and high global supply put downward pressure on prices for salmon in 2023. Additionally, exchange rates appreciated starting in 2022, putting further downward pressure on prices received by U.S. producers. Other factors such as tariffs from the trade dispute with China and heightened supply of some species on the global market are potentially more structural or longer-term features of the international market that have made the environment for the success of Alaska seafood products less favorable. Figure A10 shows the Real Effective Exchange Rate Index for Alaska seafood products.[21]

Global markets are integral to Alaska fisheries. Upwards of 70 percent of Alaska seafood products are exported although the percentage varies significantly by species. Some of the seafood products we export undergo secondary processing in another country and are subsequently imported back into the U.S. China is a major reprocessing hub of seafood for the United States and the rest of the world. The Fisheries of the United States (FUS 2022, forthcoming) estimated that 75 to 90 percent of seafood consumed in the United States is imported. This includes United States harvest products that are reprocessed abroad and imported back into the country. Global market prices are influential in determining the first-wholesale price, but the level of influence varies due to the domestic market and the product mix that gets exported.

Russia harvests a number of similar species to those found in Alaska (primarily salmon, pollock, cod, and crab) and these species compete directly in international markets with Alaska seafood products. As mentioned above, a number of these Russian fisheries have been certified as sustainable by the MSC and markets generally do not differentiate between Russian and Alaska products (Gerden, 2024a). However, media reports suggest the recent U.S. Russian seafood ban and economic sanctions imposed by the EU and others have resulted in a larger than normal price difference between higher priced Alaska pollock and lower priced Russian pollock on the international market. Russian government subsidies to modernize their fleet have resulted in an increase in the quality of Russian pollock and allowed them to dramatically increase production of higher value-added products such as filets and surimi (Asakawa, 2024), which they had

[21] The Real Effective Exchange Rate Index is defined as a weighted average of country-specific exchange rate indices (where the base period is defined to be June 1, 2010 = 1), where the weights across countries (primarily Japan, Canada, the EU, and China) are determined by Alaska species seafood exports from the Anchorage and Seattle customs districts.

previously not produced. They have also subsidized the development of salmon hatcheries with integrated processing plants that are able to produce a large quantity of high quality salmon products at very low costs. These Russian investments have the potential to provide their producers with a substantial cost advantage over U.S. produced seafood products in the next 5 to 10 years. In contrast, the Alaska seafood industry reports long-term processing challenges that require long-term investments, which are inhibited by the current environment of low prices (leading to a lack of cash with which to invest) and high interest rates. Mechanization may present a path forward to lowering processing costs and making Alaska seafood products more competitive on the global market while remaining a profitable industry.

a. First-wholesale value and inventories

Figure 1 displays the aggregate first-wholesale revenues for all state and federal fisheries in Alaska. Prices in 2023 fell precipitously (down 23 percent) to $1.72, a level not seen since 2015 (in inflation-adjusted 2022 dollars). This resulted in a decline in first-wholesale revenues of $1.2 billion, a 26 percent decrease relative to 2022. This is in part the result of the closure of several important crab fisheries as noted above, but revenue declines were also seen for a number of other major fisheries including pollock, cod, and sablefish. These declines were largely driven by decreasing prices which occurred for every major species category (Figure A8). Industry reports that the current situation is different from past economic challenges they have faced. Although there have always been large fluctuations in landings and revenues, there were usually one or two species doing well if other species were in decline. That is not the case now; prices for every major species category are in decline.

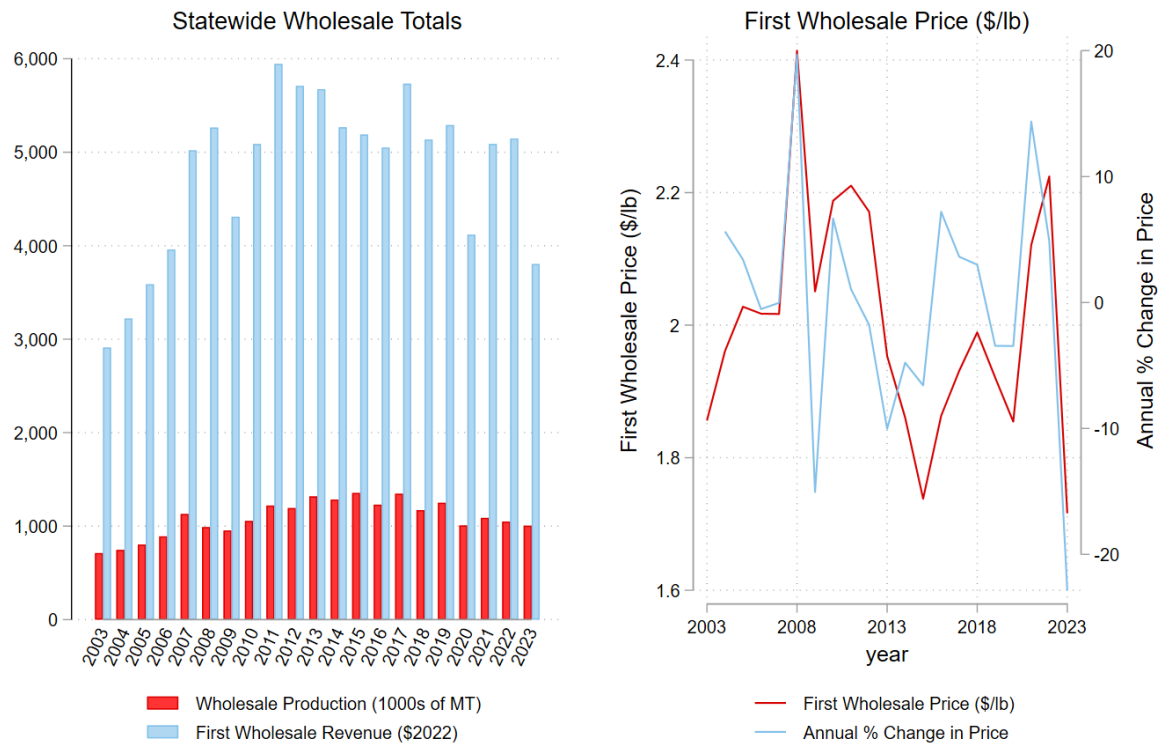

Figure 1. Statewide first-wholesale revenue and price for all species, 2003-2023 (2022$)

High seafood inventories throughout the supply chain reduce wholesale demand for seafood products, thereby putting downward pressure on prices. Industry discussions and media reports indicate high inventories of pollock (and whitefish more generally) and salmon reported in 2023 and early 2024. High interest rates compound the problems, as loans are needed to cover cash flow while holding products in storage. For pollock and other whitefish, trade data indicate a significant pulse in exports from Russia in 2022, just prior to the U.S. import ban on Russian seafood. Russia is a major supplier of salmon, pollock, and cod. This could increase whitefish and salmon inventories, thereby putting downward pressure on these prices. The pulse in Russian seafood exports did not carry through into 2023 but could have contributed to inventory challenges beyond 2022. NOAA Fisheries no longer collects inventory data, and there are no other known sources for this information. As such, it is not possible to evaluate these claims using data. However, multiple sources in industry and media reports support these claims. High inventories throughout the supply chain are a likely cause of the significant decrease in salmon prices in 2023, and also possibly impacted pollock and cod prices as well. Industry also reports that the market is working through these inventories, in part thanks to the recent USDA purchases of pollock and salmon, which should provide some price relief in 2024.

b. Economic status of the Alaska harvesting sector

Revenue losses at the first-wholesale level in 2023 are similarly reflected in the ex-vessel market. Figure 2 displays the aggregate ex-vessel revenues and metric tons (MT) landed for all state and federal fisheries in Alaska.[22] While landings were up 9 percent compared with 2022, prices in 2023 are expected to fall by 38 percent to a new low of about $0.242/lb, resulting in a decline in ex-vessel revenues of $617 million (32.3 percent) in 2023 compared with 2022.

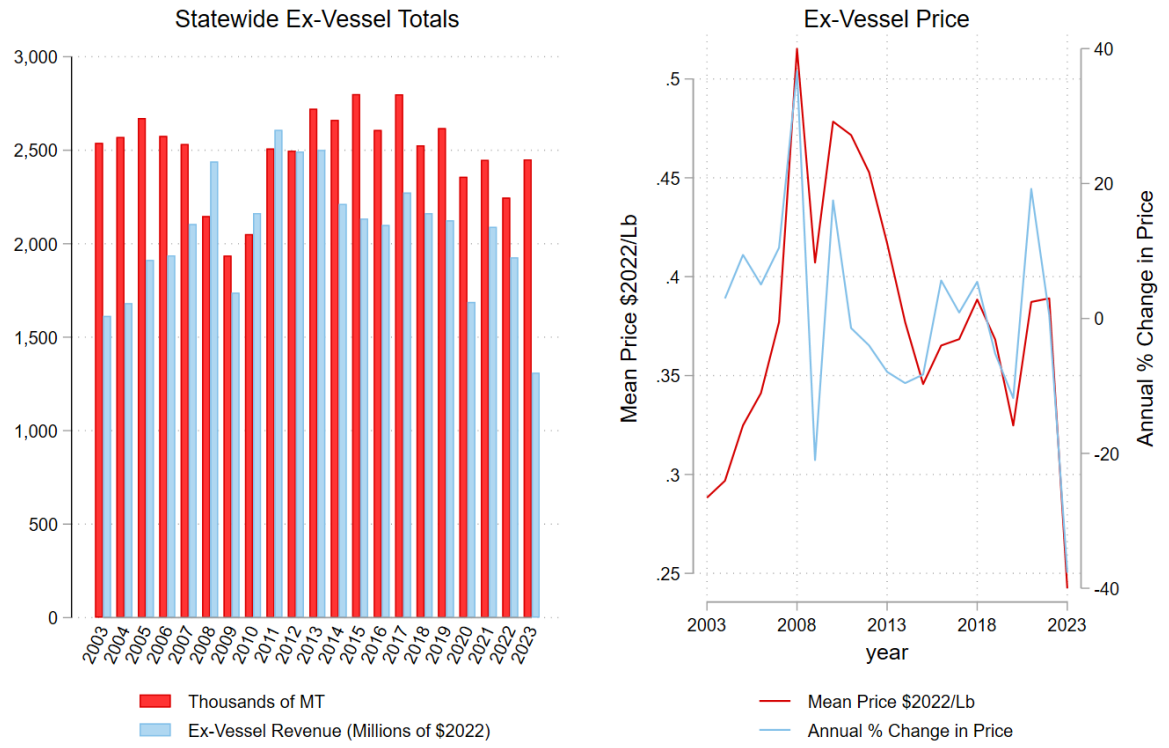

Figure 2. a) Statewide landings and ex-vessel revenue, b) statewide weighted average real ex-vessel price ($2022)

The decline in revenues is due partially to environmental conditions negatively affecting the abundance of king and snow crab stocks in the Bering Sea and Aleutian Islands (BSAI) region, but the majority of revenue declines are the result of lower prices rather than lower volumes. Volumes have remained relatively high, corresponding with increased biomass among many target species (NOAA Fisheries, 2023b, 2023c) .

[22] Revenues were deflated to 2022 dollars using the GDP chain-type deflator, accessible from the St. Louis Federal Reserve, available from: https://fred.stlouisfed.org/series/GDPCTPI.

c. Regional trends within Alaska

From 2014 through 2016 and in 2019, unprecedented marine heatwaves struck the Gulf of Alaska, elevating temperatures throughout the water column with profound ecosystem and fisheries impacts, including the closure of the lucrative Pacific cod fishery and multiple salmon run failures over multiple years (Suryan et al. 2021). The heatwaves also precipitated large-scale die offs of seabirds, as well harmful algal blooms and related paralytic shellfish poisoning events and oyster farm closures, compounding economic and food security impacts from fishery closures (ibid.). There are differences between the fisheries and communities of the Gulf of Alaska and BSAI regions of Alaska. The Gulf of Alaska has experienced a decade of ecological and economic challenges that have led to declining participation and undermined the economic status and social well-being of fishing communities. Even an unprecedented, large sablefish recruitment that followed the most recent heatwave created a flood of small sablefish on the market, resulting in huge downward pressure on sablefish prices and substantial overall revenue declines despite increasing harvests.

The BSAI has experienced different but similarly scaled ecological changes over the past decade. From 2017 to 2018, the region experienced a large marine heatwave that led to unprecedented reductions in seasonal sea ice, which affected marine food web dynamics as well as size, health, and survival rate of some fish species (Siddon et al. 2020) . In 2019, increasing warm southerly winds led to early sea ice retreat (ibid.). Over the same period, the region experienced the smallest cold pool extent on record; the cold pool is a critical part of the seafloor ecosystem affecting movement of fish and crab in the region (ibid.). Associated with these shifting environmental conditions, the BSAI has experienced unprecedented declines in important commercial fisheries, resulting in steep declines in commercial permit holders in the region (Figure 3). Figures A2 and A3 present the change in the total number of active commercial fishing vessels and active seafood processors, which have declined by 29 percent and 32 percent in the BSAI and by 20 percent and 7 percent in the GOA from 2003 to 2023. At the same time, these ecological changes in the Bering Sea have also led to substantial increases in the runs, landings, and revenues of sockeye salmon in Bristol Bay from 2017 to 2022, followed by a meaningful decline in prices and revenue in 2023 on relatively average landings (Figure A4).

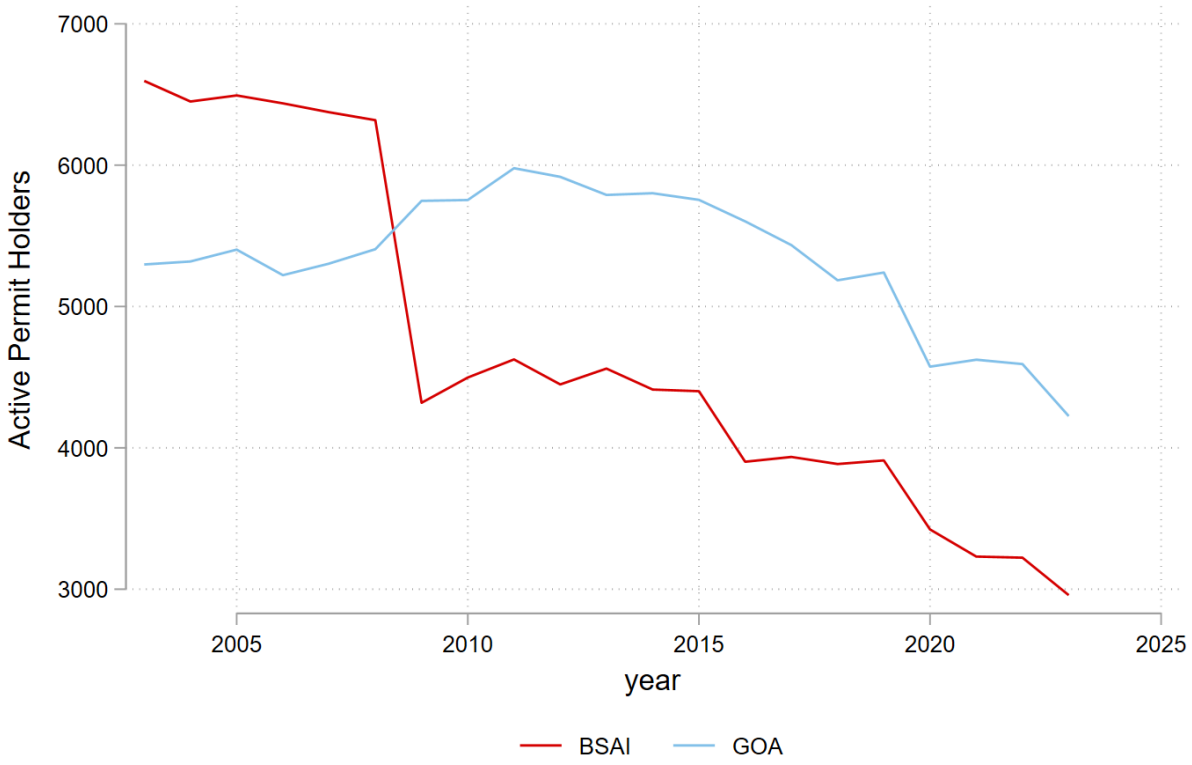

Figure 3. Count of permit holders operating in the Bering Sea and Aleutian Islands (BSAI) and the Gulf of Alaska (GOA) commercial fisheries from 2000 to 2023. (Represents active permit holders from harvest data only, omitting latent permit holders)

From 2018 to 2021, an estimated 10 billion crab disappeared from the Bering Sea associated with heightened caloric demands driven by the heatwaves, which led to the 2022 closure of the highly lucrative snow crab fishery (Szuwalski et al. 2023). Although the snow crab fishery is of significantly greater value, the snow crab closure compounded the Bristol Bay red king crab fishery closures that occurred from 2021 to 2023 (ibid.). The crab fishery closures have been devastating for the Bering Sea crab fleet, the vast majority of which rely on these crab fisheries for most of their revenues (Lewis 2023). With fewer alternative fisheries to participate in, many of the independent operators in this fleet have shifted to a variety of shoreside jobs to subsidize their fishing operations during the closures, making boat, maintenance, and insurance payments while they wait for the fishery to reopen. The ongoing closure of the snow crab fishery has been particularly devastating for the Bering Sea community of St. Paul, which lost 60 percent of its municipal tax revenue and community budget as a result of the closure (Nelson 2022). The community declared a cultural, economic, and social emergency due to the implications of these losses on the provision of basic services-public safety, electrical grids, fresh water, waste disposal, and heating (ibid.). The city has had to make up for revenue declines with increased taxes on residents and fundraising for things like emergency medical services (ibid.).

Highly important commercial and subsistence Chinook and chum salmon fisheries have also experienced tremendous declines in the Yukon and Kuskokwim Rivers (Crozier et al. 2021, Murdoch, Smith et al. 2022). Once sustaining strong commercial and subsistence fisheries, salmon runs have declined significantly in the Bering Sea, leading to cross-sector closures for the past 4 years. Alaska Native and other area residents in rural western Alaska have been deeply affected economically and culturally. Food security in the region depends heavily on subsistence fishing. In 2022, Chinook salmon (a cultural keystone species with high economic value) abundance in Western Alaska had declined by 81 percent relative to the 30-year mean, while chum salmon in the region had declined by 92 percent over the same period. These declines led to unprecedented closures of salmon-directed fisheries, which have existed in the region for thousands of years and hold significant traditional and cultural value to many inhabitants. The declines in salmon and fisheries closures have affected economies, family structures, mental health, sharing networks, and food security (Carothers et al. 2021). The BSAI region is experiencing a variety of other changes that are impacting communities and traditional practices, including extreme storms and diminished sea ice (Overland et al 2024, Overland 2024) with implications for traditional hunting practices and loss of life (Dawson et al. 2017), seabird and marine mammal die offs (Van Hemert et al. 2021), harmful algal blooms and associated paralytic shellfish poisoning (Anderson et al. 2022, Lefebvre et al. 2022), and increased marine traffic affecting access to and use of traditional hunting and fishing areas (Boylan 2021, Zhu 2023).

Figures 4 and 5 show landings, ex-vessel revenue, and weighted average prices for species caught in the GOA and BSAI regions, respectively. Despite volumes increasing in the BSAI by 7 percent and by 22 percent in the GOA in 2023 compared with 2022, estimated 2023 ex-vessel revenues are 32 percent below 2022 levels in the BSAI and 28 percent in the GOA as a result of an estimated decline in prices by 36 percent and 41 percent in the BSAI and GOA, respectively.

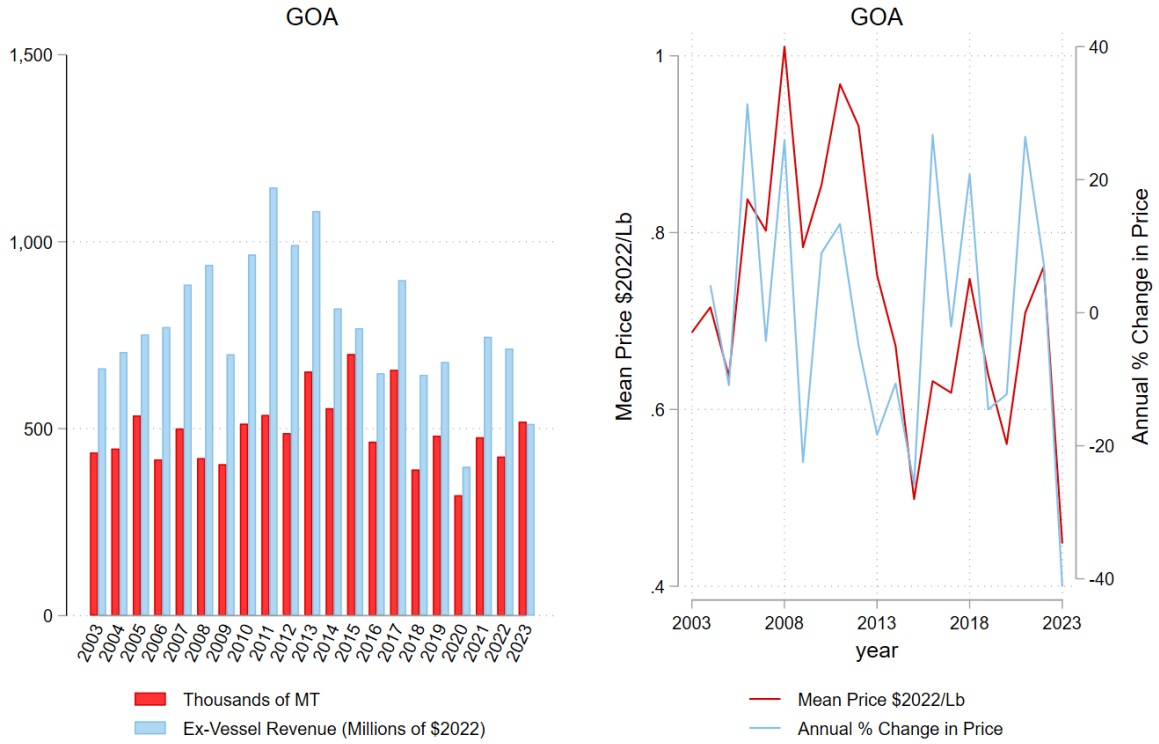

Figure 4. Gulf of Alaska landings and ex-vessel revenue, b) Gulf of Alaska weighted average real ex-vessel price ($2022)

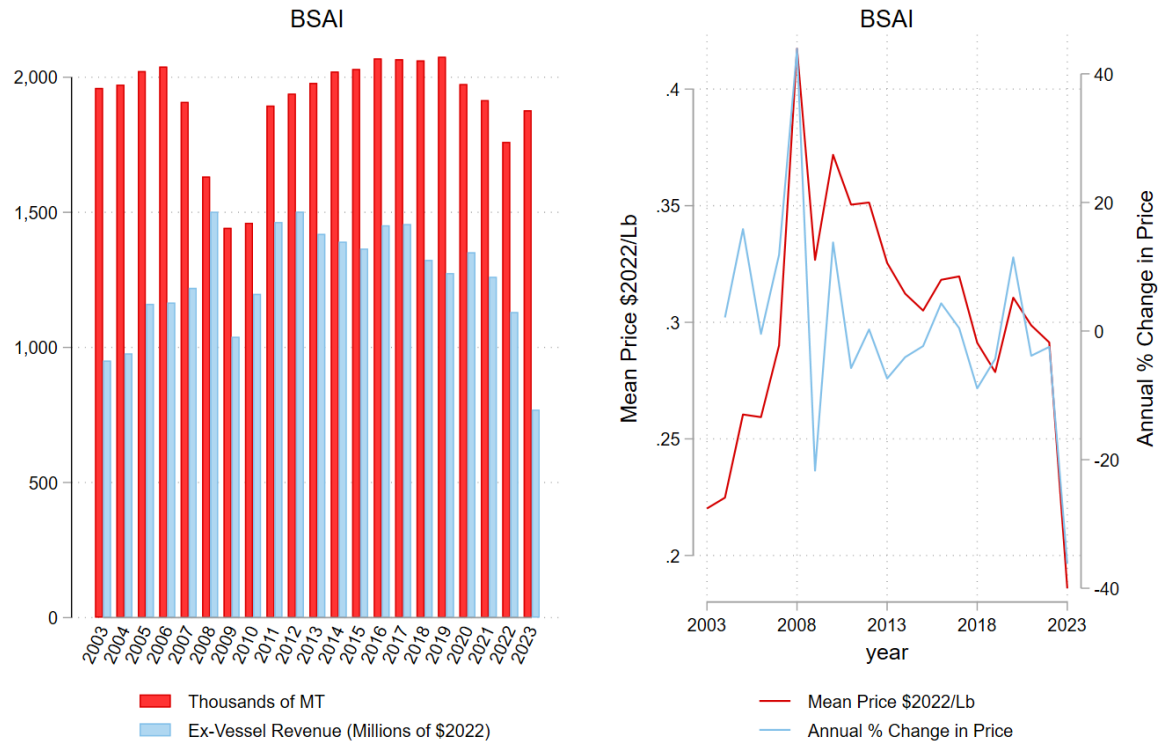

Figure 5. Bering Sea/Aleutian Islands landings and ex-vessel revenue, b) Bering Sea/Aleutian Islands weighted average real ex-vessel price ($2022)

d. Increasing costs

While prices for Alaska's seafood have declined, the cost of harvesting and processing those fisheries has increased over the past two years. The cost of capital and investment has increased with higher interest rates, higher labor costs, increased fuel prices, higher insurance costs for fishermen (associated largely with the loss of insurance providers), and general inflationary pressures on bait, food, packaging, ice, and other supplies. These increases are in part caused by supply disruptions caused around the world during the early years of the COVID-19 pandemic. We do not have sufficient cost data collections across the majority of state and federal fisheries in Alaska to estimate changes in net revenues or an estimate of profits. However, we can use publicly available data from the U.S. Federal Reserve Bank, Bureau of Labor Statistics, and U.S. Census Bureau, among others, and make informed assumptions about the relative cost shares across sectors using information gathered in 2016 (MRSAM, Multiregional Social Accounting Matrix) to generate a weighted Input Price Index (Figure 6). These gear-specific input price indices are then multiplied by the total number of active vessels fishing for that species with that gear type to create an annual Cost Index value for each gear type. Future analyses of economic and social changes in the fishing industry would greatly benefit from complete and comprehensive economic data collections supported by the fishing industry, the North Pacific Fishery Management Council, and the State of Alaska. However, the

analysis of these cost, revenue, and margin indices are helpful to understand just how dramatically the economic status of the Alaska seafood industry has changed in just two years.

Figure 6 suggests that the harvesting sector had relatively flat input prices from 2011 to 2020, but has been experiencing increasing input prices since 2021 that accelerated sharply in 2022 and persisted into 2023.

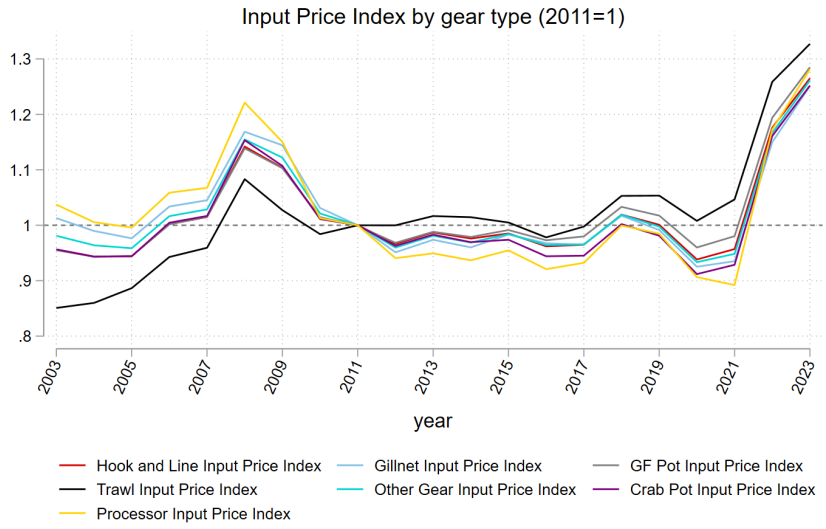

Figure 6. Calculated input price indices for several gear types using cost shares derived in section A.3

e. Declining ex-vessel margins

The revenue and cost indices both generally declined over time from 2011 to 2021, resulting in a relatively stable Ex-vessel Margin Index around 1. However, increased costs in 2022-2023, coupled with the 2023 lower ex-vessel and first-wholesale prices for Alaska seafood products, resulted in a dramatic decline in the Ex-vessel Margin Index by nearly 50 percent in the past 2 years. While we are unable to provide estimates of profit or loss for the sector, the seafood industry is generally acknowledged to be operating on small margins and this 50 percent reduction in the Ex-Vessel Margin Index represents increasing pressure of commercial operators on both sides of the balance sheet, thereby risking the economic sustainability of both harvesting and processing operations in Alaska.

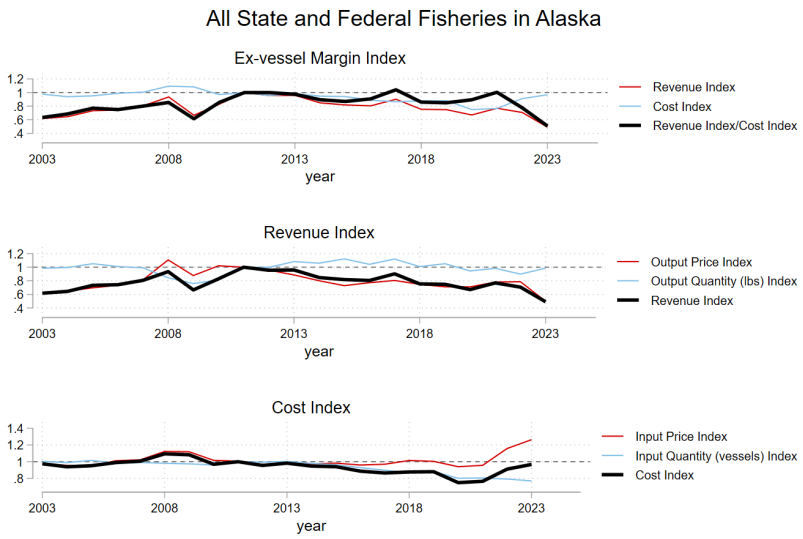

Figure 7. Ex-vessel, revenue,cost, and Operating Margin Indices for all state and federal fisheries in Alaska.

These indices were also developed for the BSAI and GOA regions respectively, shown in Figure 8, and for individual fisheries, as shown in Figures A4-A7. The decline in the BSAI was more recent, while the GOA has been experiencing many years of Ex-Vessel Margin Index values below 2011 values, including 2022 and 2023.

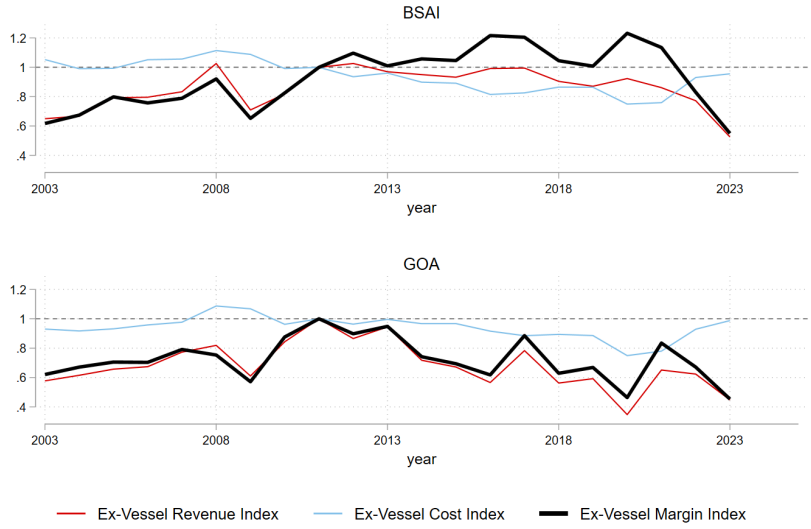

Figure 8. Ex-Vessel Margin Indices for all state and federal fisheries in the GOA and BSAI regions of Alaska (2011=1)

f. Regional economic and employment impacts

Figure 9 and Table A6 present a summary of the results of the economic impacts for important regional economic variables, such as the change in output, employment (number of jobs), and state and local government revenue. The two Southwest Alaska regions experiencing the largest changes in industry output are the Aleutians East Borough and Bristol Bay Borough regions, whose total outputs are estimated to decrease by $573 million and $404 million, respectively. Among the six Southwest Alaska regions, these two regions are suffering the largest decrease in total employment; the total employment in Aleutians East Borough and Bristol Bay Borough has decreased by 6,036 and 9,713 jobs, respectively.[23] The large impacts on employment in these regions (Aleutians East Borough and Bristol Bay Borough) are obtained, among other things because the initial shock to the region is substantially large (about 80% of total seafood industry output in 2014) and because seafood processing (and other industries) in these remote areas depends to a large extent on non-Alaska residents, most of whom are seasonal workers. In 2022, 83% and 92%, respectively, of processing workers in these areas are nonresidents while 81% and 77%, respectively, of all workers in these areas are nonresidents (Alaska Department of Labor and Workforce Development, 2024). Thus, non-Alaska seasonal workers are likely to account for a large portion of the total impacts on employment in a number of western Alaska BCAs. Since the impacts on job losses in this report include both residents and non-residents, the job losses for only the residents of these areas will likely be smaller than the impacts reported here.[24] These job estimates should be compared with the total number of jobs in Alaska (443,598) used in the MRSAM model, which uses 2014 as a baseline. The Rest of Alaska region also experiences significant adverse impacts. The total output in the Rest of Alaska region decreased by $1,095 million while the total employment declined by 6,952 jobs.

[23] This includes fishing and non-fishing jobs such as gear suppliers, shipyards, repair and maintenance services, barge and shipping employment, the producers of oil and gas products, and all jobs needed to produce the other primary and intermediate inputs that are necessary for the Alaska seafood sector to operate.

[24] Additionally, it is not appropriate to compare the employment impacts with the area's population size because the two variables (employment and population) are measured differently. While employment includes both residents and non-residents, the population includes only the residents. Also estimates of employment vary depending on the definition of employment. While seafood industries' employment in 10MRSAM is defined as the number of unique individuals hired by the industries over the year, non-seafood industries' employment is defined as the sum of full- and part-time jobs, temporary positions, and proprietors (self-employed). A worker may have more than one job over the year. Therefore, it is possible that the size of employment in this report is larger than the population size for these areas. Because of the high ratio of non-resident workers and the definition of employment used in this report, it is possible that the impacts on employment are larger than the population size of these two areas.

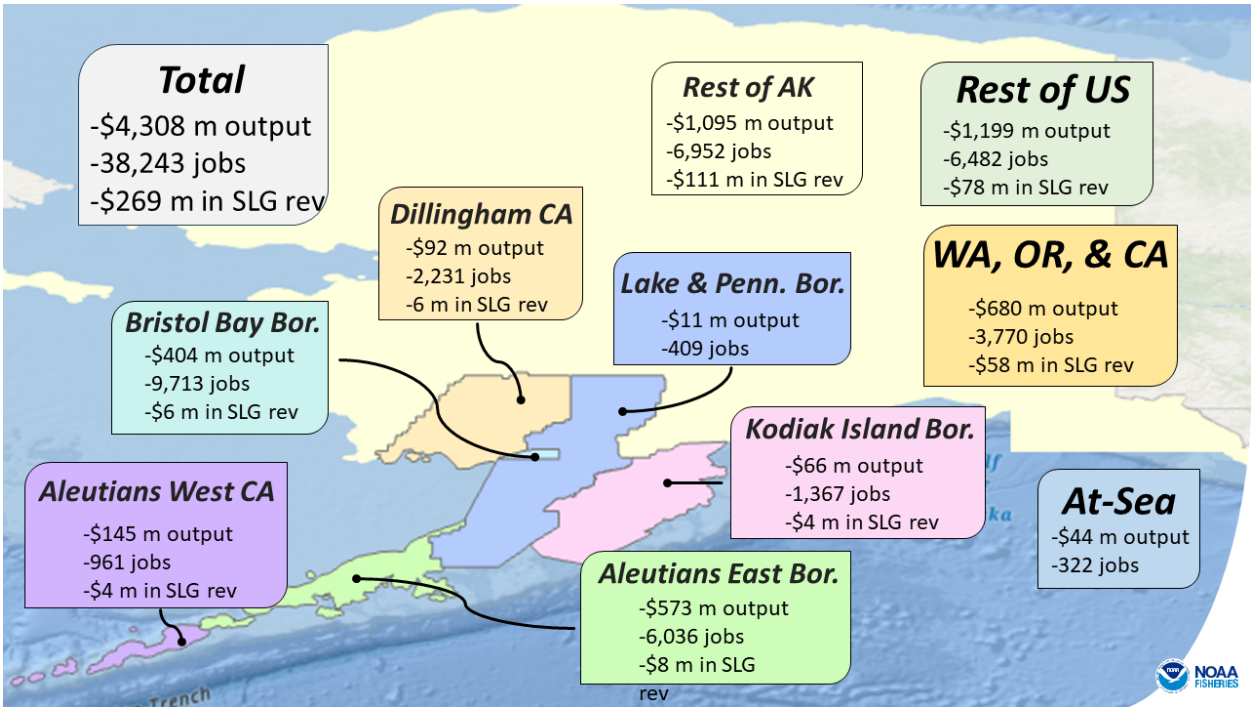

Figure 9: Summary of the 2022-2023 revenue shock results presented in Appendix A.7, Table A6.
SLG - state and local government; AWCA - Aleutians West Census Area; AEB - Aleutians East Borough; DCA - Dillingham Census Area; BBB - Bristol Bay Borough; LPB - Lake and Peninsula Borough; KIB - Kodiak Island Borough; At-Sea - At-sea sector

The adverse economic impacts are not limited to Alaska. The impacts on the output and employment in Washington, Oregon, and California and the Rest of the United States region are substantial due to Alaska fisheries' heavy reliance on importing factors of production and commodities from these two regions. Total output in Washington, Oregon, and California and the Rest of the United States region decreased by $680 million and $1.2 billion, respectively. Total employment declined by 3,770 jobs in Washington, Oregon, and California while the Rest of the United States region lost 6,482 jobs. The combined output impacts on these two non-Alaska regions ($1.8 billion) account for 44 percent of the total U.S. impacts ($4.3 billion) and 26 percent of the total U.S. employment impacts (10,252 jobs). More detailed results are shown in section A.7 and Table A6.

3. Implications of market and fisheries downturns for well-being

This section summarizes well-being implications from fisheries downturns in Alaska, based on existing literature and research, conversations with fishermen and community members, and

media reports. The impact of these recent market disruptions for the region have likely not been fully realized yet, and they compound existing issues and undermine well-being in various ways. Fishermen and fishing communities express concerns that what is expected to be a multi-year seafood market decline will have numerous lagged impacts. A prominent comparison that emerges in the discourse is that of the salmon market crash in the early 2000s (associated with the emergence of farmed salmon on the global seafood market), which led to nearly a decade of fisheries revenue decline in the region, with the loss of a generation of fisheries participants. A multi-year seafood market decline could result in lost participation and the exit of fishing families from communities as well as compound losses in community taxes and spending revenues. In the past, such community-level losses have cascaded into further population and revenue declines associated with, among others, increasing taxation to make up for revenue declines, declining school enrollment and quality, and closures of support services and other community businesses.

There is also a strong connection between small-scale commercial fishing and food security in Alaska. Commercial vessels are used for subsistence fishing, commercial fishing is used to subsidize subsistence fishing, and commercial vessels bring back "homepack" from commercial fishing trips (fish harvested during commercial fishing trips that are kept by the permit holder for personal consumption or sharing). The decline of commercial fishing therefore represents a prominent food security concern for Alaska (Szymkowiak and Kasperski, 2020). This compounds increasing food insecurity associated with, among others, loss of traditional hunting and fishing practices due to changing natural resource conditions, increasing extreme weather events, issues with community barge deliveries, and increasing food prices in an area where grocery costs are at least 25 percent higher than in other states.

Coastal communities and fishermen report declining mental and physical health associated with declining fishing livelihoods, associated social disruptions, and the uncertainty of fisheries and markets into the future, in response to increasingly variable ecological and market conditions over the past several years. The stress of the seafood market crisis has compounded a decade of uncertainty for fishermen about the health of fisheries and the general capacity to sustain fishing livelihoods (Szymkowiak and Steinkruger, 2023). Fishermen also report declining physical health as they try to make up for revenue declines by going out into poor weather conditions and ignoring physical ailments due to limited financial resources for medical appointments. Fishermen, especially younger fishermen with large debt loads from high access costs, express feeling like they are "on a knife's edge" in terms of being able to survive as fishermen and within their fishing communities more broadly. Fishing communities report increases in mental health crises-particularly for youth-as people face increasing uncertainty economically, socially, and culturally. Stress and other mental health issues, associated substance abuse issues, and even suicide related to declining fisheries and connections to marine ecosystems have become prominent in regional discourse (Szymkowiak and Rhodes-Reese, 2020).

Declining fishing conditions around Alaska have also aggravated ongoing equity in fisheries access and distribution issues and disruptions to social relationships in the region. Closures of

salmon subsistence fisheries that have sustained Western Alaska fishing communities for thousands of years have put greater focus on further reducing the relatively low levels of salmon bycatch by groundfish catcher processors in the region, leading to contentious policy conversations comparing the cultural and economic value of a single fish. Hardships in fisheries also deepened inequities that emerged from the institution of limited access privilege programs (LAPPs) in recent decades; fishermen who bought into these fisheries need to pay off loans even under poor fishing conditions or declining markets, whereas individuals that were allocated initial harvesting or access privileges are generally better able to weather a greater number of challenging fishing seasons. These compound inequities have exacerbated social strains within and across fishing communities, making it increasingly difficult to hold constructive conversations about local budget tradeoffs and paths forward under declining funding for services.

In the face of evolving climate-driven impacts to ecosystems and fisheries in the region, which are disrupting and destabilizing fishing livelihoods and communities, these recent market disruptions undermine fishermen's capacity to be resilient and maintain their fishing businesses. As resources in the region decline and experience tremendous interannual changes, stability (and increases) in fish prices are critical to resilience for fishermen. Moreover, fishermen are expending resources–financial, human, and social–to address profit shortfalls, leaving them worse off in the face of climate-driven impacts.

4. Discussion

The Alaska seafood industry has been undergoing unprecedented changes in both costs and revenues over the past two years. The revenue losses between 2022 and 2023 are estimated to be a $1.8 billion shock to the Alaska economy, resulting in a loss of more than 38,000 fishing and non-fishing jobs in the United States and a loss of $4.3 billion in total U.S. output and a total decrease of $269 million in state and local tax revenues. A significant share of the total U.S. economic impacts from the decline in Alaska fisheries is felt in non-Alaska regions, with the impacts on output in the non-Alaska regions ($1.9 billion) accounting for 44 percent of the total U.S. impacts.

These impacts to the Alaska seafood industry are the result of a variety of interacting factors as explained elsewhere in the report, including lower seafood prices, higher input costs, residual impacts from the COVID-19 pandemic, changes in business models, international trade barriers (tariff and non-tariff) and competition, the strengthening of the U.S. dollar making U.S. seafood exports more expensive, a lack of USDA-type revenue insurance for harvesters or processors, climate change, and plant closures. These factors result in a number of negative cumulative impacts to individual and community well-being. These impacts threaten the sustainability of

the Alaska fishing industry, many coastal and Alaska Native communities, and Alaska Native cultural traditions.

Nearly all of these factors that have resulted in the changes we are observing are occurring after the harvest, and additional studies are necessary (some are underway) to track and understand how U.S. seafood is distributed and how that benefits U.S. consumers and producers. The Alaska legislature recently set up a Joint Legislative Seafood Industry Task Force to look at responses to the crisis, with a report expected in January 2025 (Rosen 2024a). Having better information on seafood markets will also allow NOAA Fisheries and other parts of the federal government to provide timely communications, promotions, and market development information to industry and our trading partners to strengthen the entire U.S. seafood sector, which are two goals of NOAA Fisheries' National Seafood Strategy. Future work could also include an assessment of the recreational and subsistence fishing sectors, to the extent data allow. Additional data gathering and analysis to identify changes to state, town, community, and tribal revenues associated with each type of fishing would provide some of the necessary information to update MRSAM and perhaps disaggregate the Rest of Alaska region into a number of coastal and non-coastal Alaska Borough and Census areas.

5. Summary

- An estimated direct loss of $1.8 billion occurred in Alaska seafood industry revenues between 2022 and 2023, which resulted in an estimated total loss of more than 38,000 fishing and non-fishing jobs in the United States, a loss of an estimated $4.3 billion in total U.S. output, and an estimated total decrease of $269 million in state and local tax revenues. The Ex-Vessel Margin Index, a measure of profitability, also declined by 50 percent in 2022 and 2023, which was the compounded effect of decreased prices in 2023 as well as increased costs for key inputs to the production process, including labor rates (wages), energy prices, and interest rates starting in 2022.
- The decrease in revenues in 2023 is largely driven by low seafood prices across nearly all Alaska species as a result of global market forces, including exchange rates and tariffs; high inventories and high levels of global supply; lower global consumer demand for seafood due to inflation; and lower cost of seafood production and processing in countries that compete with U.S. seafood products. None of these market forces are eligible causes for federal fisheries disaster support, but these market factors exacerbate stresses on the Alaska seafood industry from recent fishery disasters such as the collapse of certain crab and salmon stocks.
- Recent marine heat waves in both the Gulf of Alaska and Bering Sea have resulted in drastic changes to these ecosystems including population declines and commercial fisheries closures in several important Alaska commercial and subsistence species including Pacific cod, snow crab, chum salmon, and chinook salmon.

- The Alaska seafood industry represents an important way of life, sense of place, community, and identity, as well as a prominent food security provider for many Alaskans; these recent changes caused significant decreases in Alaska state, town, and community revenue and threaten the sustainability of Alaska's communities and their way of life.

Appendix:

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A.2 Nowcast regression models

Table A1. 2023 Nowcast regression model list

Data Source	
Comprehensive_FT	**Comprehensive_CAS**
Monthly time series from 1991-2023	**Monthly time series from 2007-2023**
Chinook Trawl/Net	BSAI Other CAS species Trawl/Net
Chinook Hook and Line	BSAI Other CAS species Hook and Line
Chum Trawl/Net	BSAI Other CAS species Pot
Chum Hook and Line	BSAI Flatfish Trawl/Net
Coho Trawl/Net	BSAI Flatfish Pot
Coho Hook and Line	BSAI Pacific cod Trawl/Net
Other Fish Ticket species Trawl/Net	BSAI Pacific cod Hook and Line
Other Fish Ticket species Hook and Line	BSAI Pacific cod Pot
Other Fish Ticket species Pot	BSAI Pacific cod Other gear
Other Fish Ticket species Other gear	BSAI Pollock Trawl/Net
Halibut Trawl/Net	BSAI Pollock Hook and Line
Halibut Hook and Line	BSAI Pollock Pot
Halibut Pot	BSAI Rockfish Trawl/Net
Halibut Other gear	BSAI Rockfish Hook and Line
King crab Pot	BSAI Rockfish Pot
Other crab Pot	BSAI Sablefish Trawl/Net
Pink Trawl/Net	BSAI Sablefish Hook and Line
Pink Hook and Line	BSAI Sablefish Pot
Other Shellfish Trawl/Net	GOA Other CAS species Trawl/Net
Other Shellfish Pot	GOA Other CAS species Hook and Line
Other Shellfish Other gear	GOA Other CAS species Pot
Sockeye Trawl/Net	GOA Flatfish Trawl/Net
Sockeye Hook and Line	GOA Flatfish Hook and Line
Tanner Crab Pot	GOA Flatfish Pot
	GOA Pacific cod Trawl/Net
	GOA Pacific cod Hook and Line
	GOA Pacific cod Pot
	GOA Pacific cod Other gear
	GOA Pollock Trawl/Net
	GOA Pollock Hook and Line
	GOA Pollock Pot
	GOA Rockfish Trawl/Net
	GOA Rockfish Hook and Line
	GOA Rockfish Pot
	GOA Sablefish Trawl/Net
	GOA Sablefish Hook and Line
	GOA Sablefish Pot

A.3 Cost indices input data

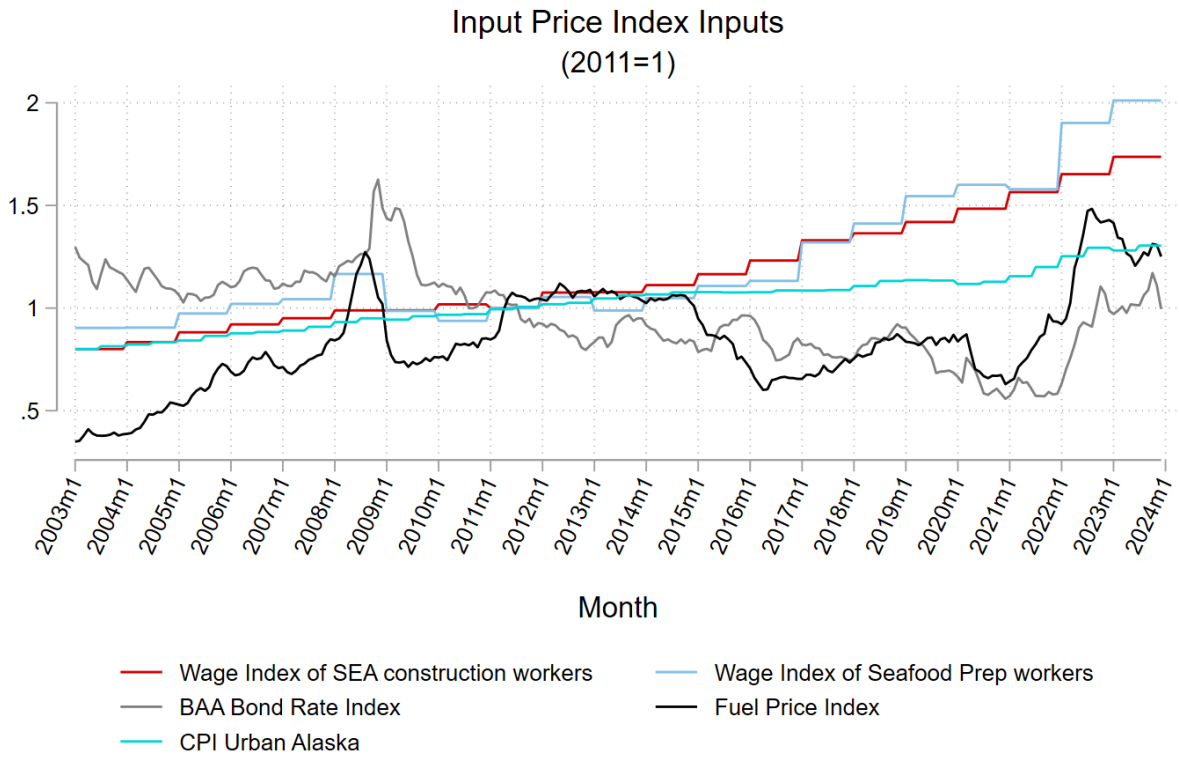

Figure A1. Input Price Index input data, where 2011=1

Table A2. Cost shares across input categories by gear/sector

Sector / Category	Labor (w_1)	Energy (w_2)	General (w_3)	Return to Capital (w_4)	Total
Hook and Line	21.5%	7.8%	23.2%	47.5%	100%
Gillnet	23.2%	2.2%	18.6%	56%	100%
Groundfish pot	25.7%	7.0%	20.6%	46.6%	100%
Trawl	24.9%	15.8%	30.1%	29.2%	100%
Other	22.9%	5.5%	20.2%	51.4%	100%
Crab pot	20.0%	10.0%	20.0%	50.0%	100%
Processors	20.0%	5.0%	15.0%	60.0%	100%

A.4 Active vessels and processors by region in Alaska

Figure A2. Number of active commercial fishing vessels in all state and federal fisheries in the GOA and BSAI regions of Alaska (2011=1)

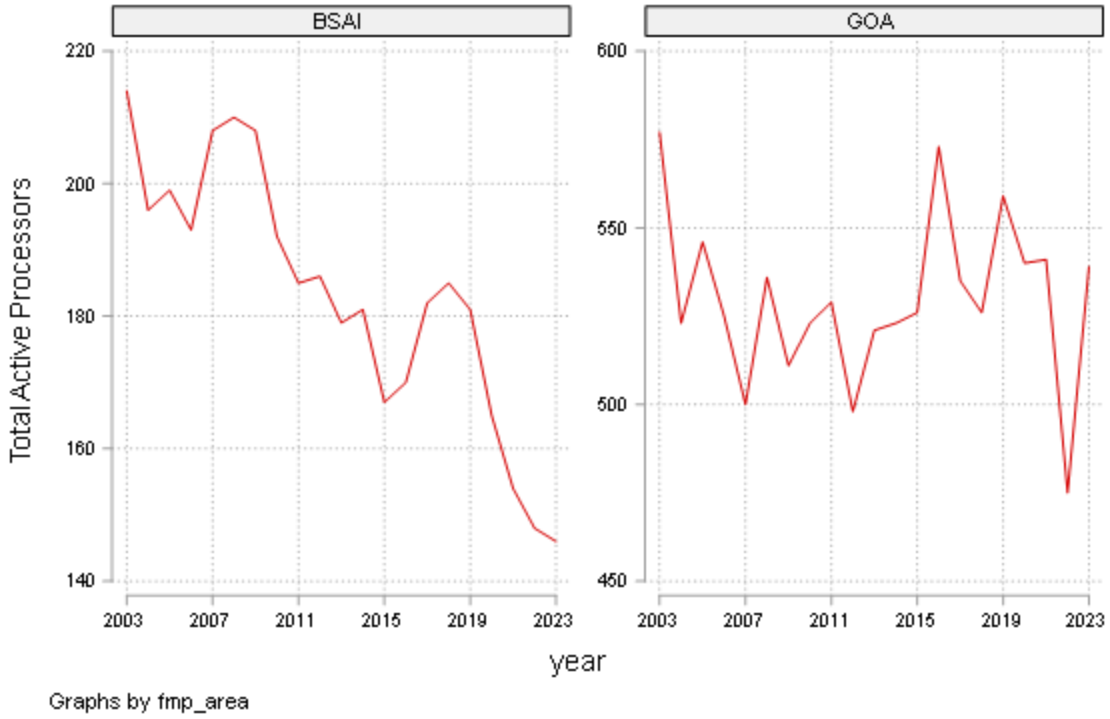

Figure A3. Number of active seafood processors of all state and federal fisheries in the GOA and BSAI regions of Alaska (2011=1)

A.5 Ex-vessel Operating Margin Indices by fishery

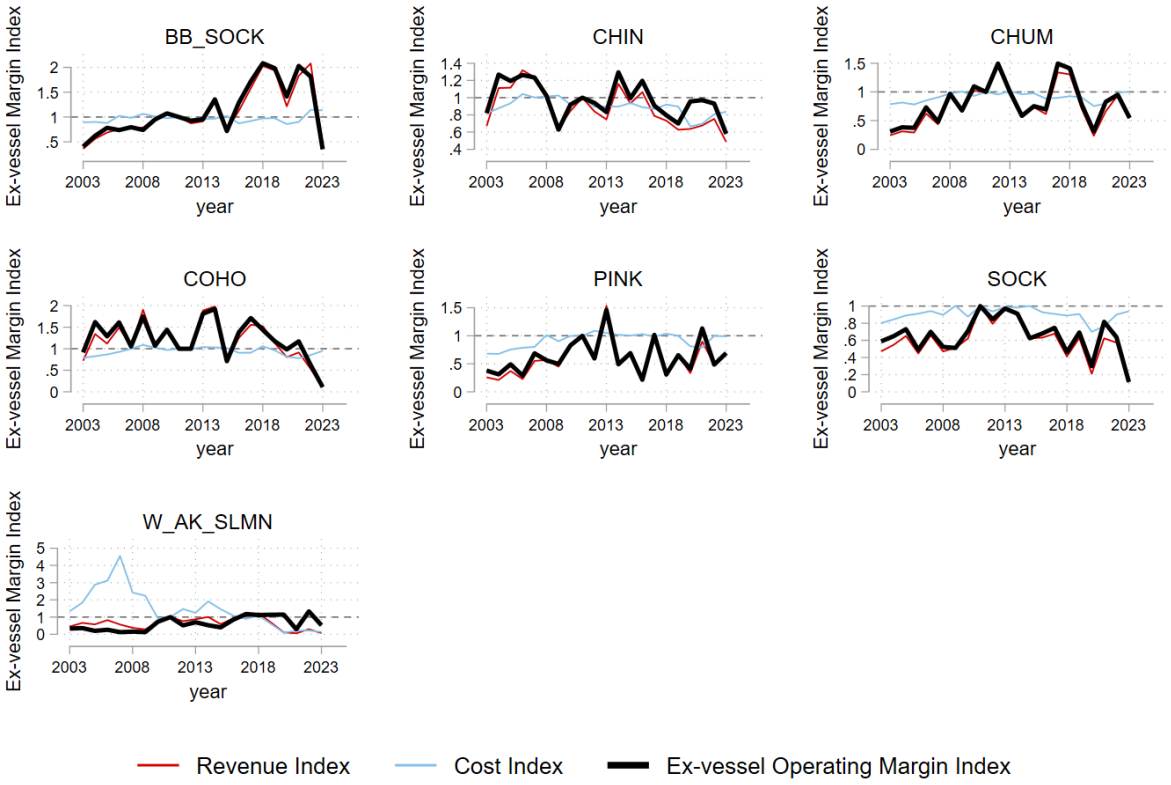

Figure A4. Ex-vessel revenue, cost, and Operating Margin Indices by fishery for salmon species BB_SOCK - Bristol Bay Sockeye salmon; CHIN - Chinook salmon; CHUM - chum salmon; COHO - coho salmon; PINK - pink salmon; SOCK - sockeye other than Bristol Bay; W_AK_SLMN - total chum and Chinook salmon harvested in western Alaska by CFEC permit types: S 04P, S 04Y, S 08P, S 04Z, S 04X, and S 04W

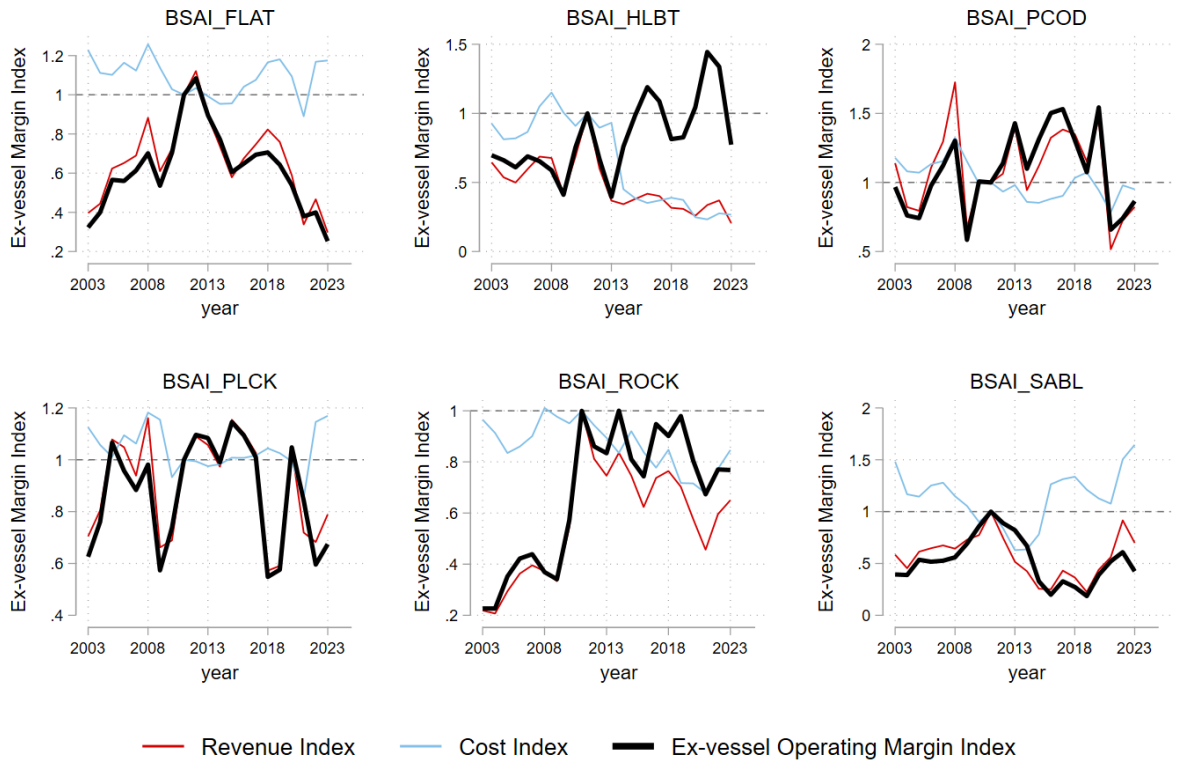

Figure A5. Ex-vessel revenue, cost, and Operating Margin Indices by fishery for BSAI groundfish species

BSAI_FLAT - BSAI flatfish; BSAI_HLBT - BSAI halibut; BSAI_PCOD - BSAI Pacific cod; BSAI_PLCK - BSAI pollock; BSAI_ROCK - BSAI rockfish; BSAI_SABL - BSAI sablefish (black cod).

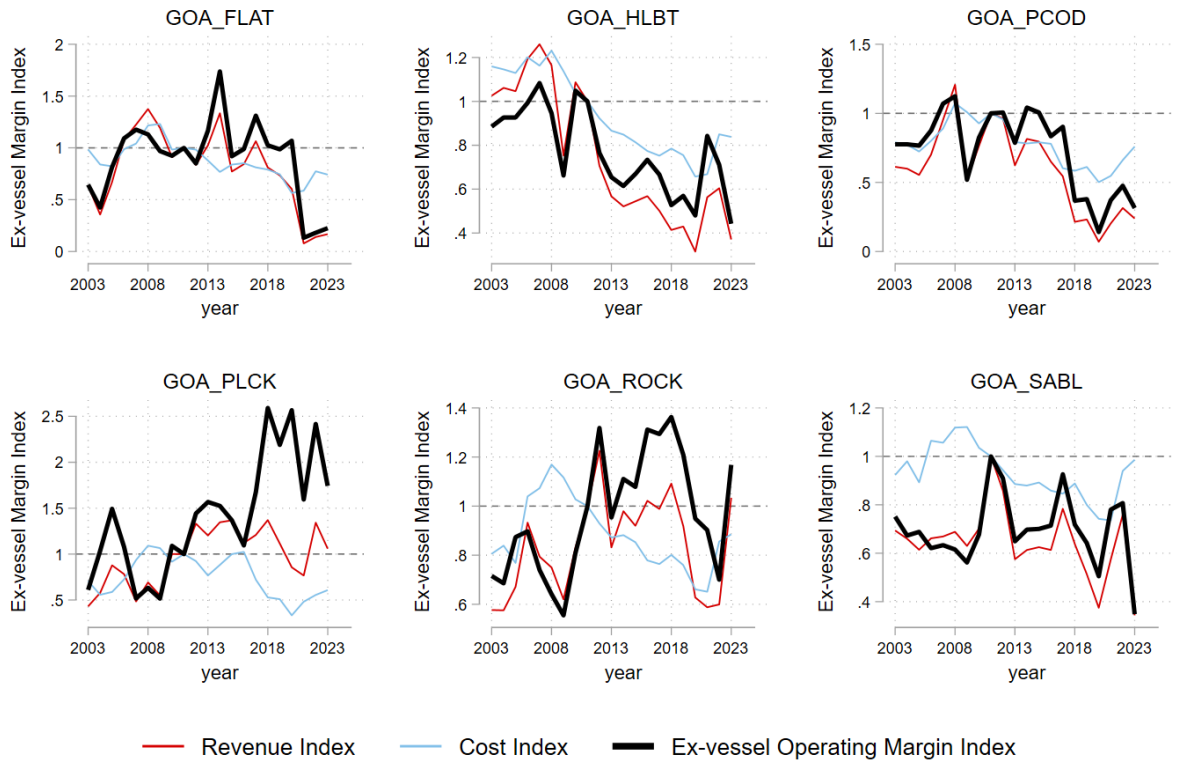

Figure A6. Ex-vessel revenue, cost, and Operating Margin Indices by fishery for GOA groundfish species

GOA_FLAT - GOA flatfish; GOA_HLBT - GOA halibut; GOA_PCOD - GOA Pacific cod; GOA_PLCK - GOA pollock; GOA_ROCK - GOA rockfish; GOA_SABL - GOA sablefish (black cod).

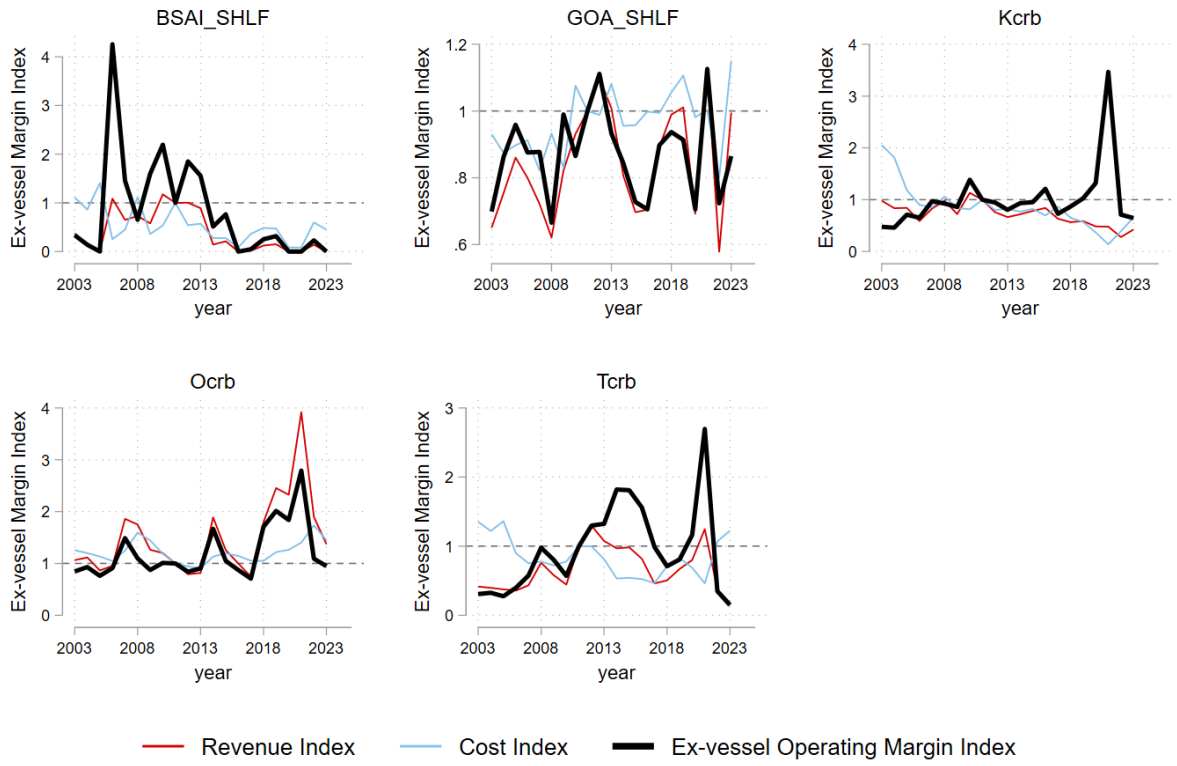

Figure A7. Ex-vessel revenue, cost, and Operating Margin Indices by fishery for shellfish species BSAI_SHLF - BSAI non-crab shellfish; GOA_SHLF - GOA non-crab shellfish; Kcrb - King crab; Ocrb - Other crab (mostly dungeness); Tcrb - Tanner crab including snow crab.

A.6 Global markets

Price changes at the first-wholesale level are largely driven by market forces. The reasons for the change in price for a given species can vary depending on the supply chains, the markets those products feed, and international competition. Most Alaska seafood products are at least in part exported and compete on the global seafood market. While prices in 2022 were down for pollock, cod, halibut, herring, and crab species, the drop in 2023 prices came after increases in 2022 and prices were near levels seen over the past decade (Figure 1). For flatfish, rockfish, and sablefish, prices in 2020-2023 are low relative to price levels over the past decade. For salmon in particular there was a very large decrease in 2023 prices to a level not seen since 2015. The decrease in prices in 2023 relative to 2022, or low levels in recent years, across all species has resulted in significant revenue reductions.

In 2018 the United States and China entered into a trade dispute where each country put significant tariffs on most goods traded between the two countries. China, in an effort to protect its domestic seafood reprocessing industry, excluded tariffs from seafood products that were brought into the country to be reprocessed and then subsequently exported. But China did impose tariffs on seafood products entering into the Chinese domestic market for consumption (Godfrey 2024). Industry reports indicate that these tariffs have inhibited the expansion of seafood products into the Chinese domestic market-a growing market for seafood products (SeafoodNews.com 2018). Furthermore, seafood products entering the U.S. domestic market from China, including those originally harvested in U.S. waters and reprocessed in China, were subject to U.S. tariffs. These tariffs can put upward pressure on the prices of domestic seafood imported from China and downward pressure on upstream suppliers of seafood products including domestic seafood producers. The impact of the trade dispute and tariffs that began in 2018 would not explain the significant price drop in 2023, but it is a barrier to the expansion of markets for U.S. seafood products and price growth.

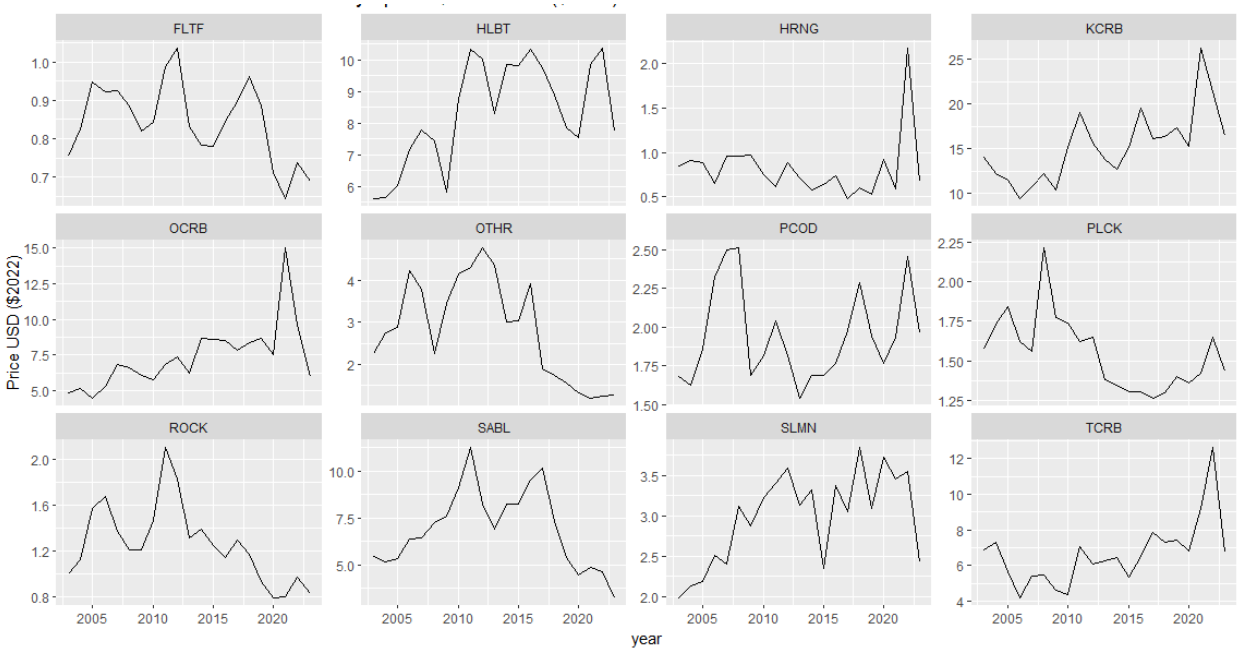

Figure A8. Statewide first-wholesale prices by species, 2003-2023 ($2022)

A.7 MRSAM regions, species groups, and revenue shocks

The 10 regions in the MRSAM model include an at-sea "region" (AT-SEA), six SWAK boroughs and census areas (BCAs), the rest of Alaska (RAK), U.S. West Coast (WOC, Washington, Oregon, and California), and rest of the U.S. (Rest of US). The six SWAK BCAs are as follows: Aleutians West Census Area (AWCA – including Atka, Unalaska and Dutch Harbor), Aleutians East Borough (AEB – including Akutan, King Cove and Sand Point), Lake and Peninsula Borough (LPB – including Chignik, Ugashik and Egegik), Bristol Bay Borough (BBB - Naknek), Dillingham Census Area (DCA – including Dillingham and Togiak), and Kodiak Island Borough (KIB) (Figure A9). Descriptions of regions and species included in the MRSAM model are presented in Table A3 below.

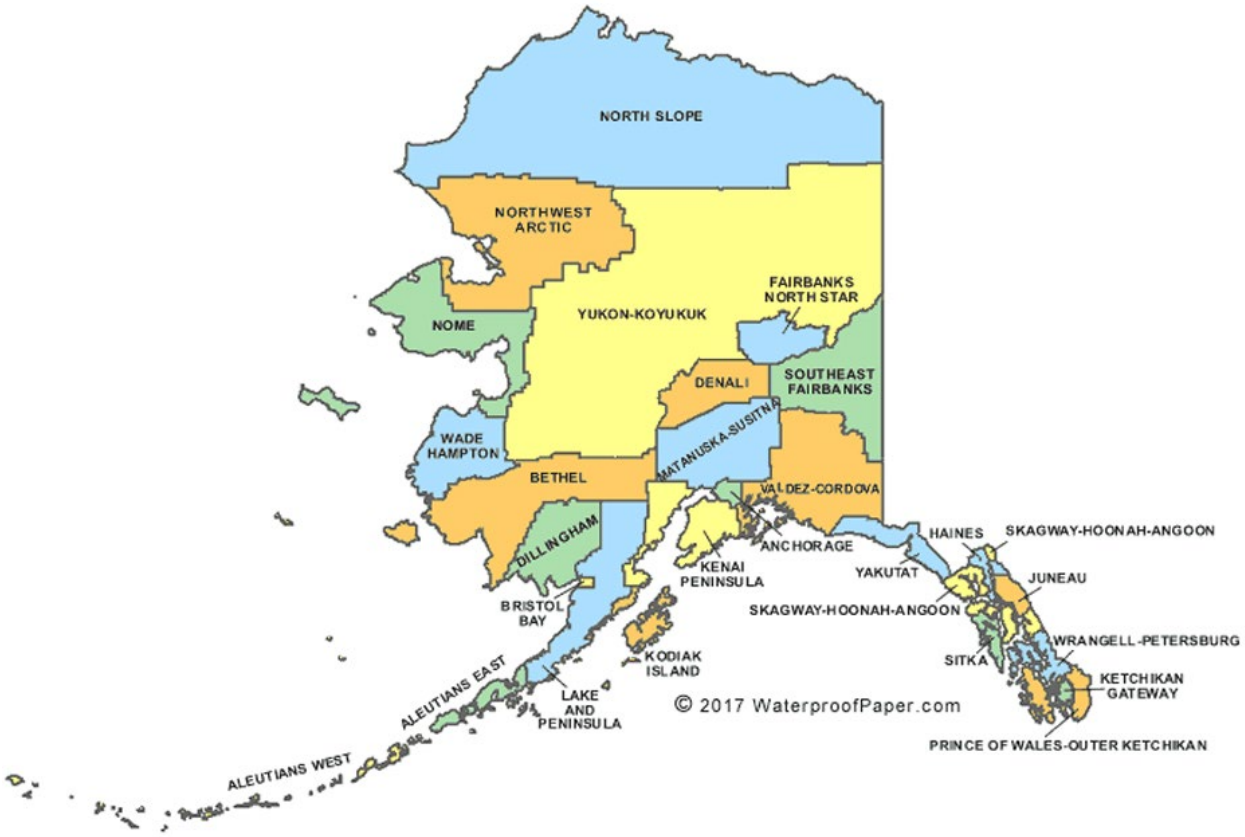

Figure A9. Alaska borough and census areas

Table A3. Description of acronyms for regions and species

Acronym	Description
Borough/Census Area (BCA) or Region	
AT-SEA	At-sea sector including catcher-processors and motherships
AWCA	Aleutians West Census Area
AEB	Aleutians East Borough
LPB	Lake and Peninsula Borough
BBB	Bristol Bay Borough
DCA	Dillingham Census Area
KIB	Kodiak Island Borough
RAK	Rest of Alaska
WOC	West Coast region – Washington, Oregon, and California
Rest of US	Rest of United States
Species	
PCOD	Pacific cod

PLCK	Pollock
HLBT	Halibut
SABL	Sablefish
ROCK	Rockfish
FLTF	Flatfish
KCRB	King crab
TCRB	Tanner crab including snow crab
OCRB	Other crab
SLMN	Salmon
OTHR	Other species

Table A4. Ex-vessel revenue input shock (change from 2022-2023)

Sum of shock_2223	Column Labels									
Row Labels	**AEB**	**ATSEA**	**AWCA**	**BBB**	**DCA**	**KIB**	**LPB**	**RAK**	**WOC**	**Grand Total**
FLAT	131,536	(21,214,320)	87,529		-	240,980	-	45,793	490	(20,707,992)
Halibut	(13,012,960)	-	(905,013)	(29,001)	(19,388)	(9,865,239)	-	(33,372,392)	(1,088,136)	(58,292,129)
Kcrab	4,324,023	1,697,975	18,476,972			75,193		(350,721)		24,223,442
Ocrb	(3,480,420)	-	(992,388)			(1,829,764)		761,637	94,256	(5,446,679)
Other	443,484	4,915,068	561,269	(728,387)	(229,996)	1,558,078	-	9,500,154	115,997	16,135,668
PCOD	(8,596,562)	24,649,728	(2,132,175)		-	(3,821,184)	-	938,351	(21,852)	11,016,306
PLCK	(25,706,816)	19,590,928	(16,350,408)		-	(4,798,744)		(8,640,599)	(6)	(35,905,645)
ROCK	201,221	7,488,426	135,451		-	2,779,152	-	40,905	(7,898)	10,637,255
SABL	(18,226,690)	1,817,806	(190,818)		-	(9,985,716)	-	(39,395,620)	186,904	(65,794,134)
Salmon	(59,991,436)	(6,151,439)	-	(242,998,624)	(42,028,436)	(16,575,584)	(24,348,810)	(61,875,648)	(756,684)	(454,726,661)
Tcrb	(7,402,337)	(977,815)	(26,662,132)			3,314,592		(6,265,969)		(37,993,660)
Grand Total	**(131,316,957)**	**31,816,358**	**(27,971,712)**	**(243,756,012)**	**(42,277,820)**	**(38,908,237)**	**(24,348,810)**	**(138,614,109)**	**(1,476,930)**	**(616,854,229)**

Table A5. First-wholesale revenue input shock (change from 2022-2023)

Sum of wsimpact_22_to_23	Column Labe									
Row Labels	**AEB**	**ATSEA**	**AWCA**	**BBB**	**DCA**	**KIB**	**LPB**	**RAK**	**WOC**	**Grand Total**
FLTF	-	(41,320,866)	(376,984)			1,573,279	-	(837)		(40,125,408)
HLBT	(15,076,512)	(169,768)	1,124,748	4,680	-	(7,241,772)		(44,032,372)		(65,390,996)
KCRB	6,696,781	3,425,860	9,575,959			-		3,771,954		23,470,554
OCRB	(15,162,925)	476,191	(3,097,755)			(6,775,557)		3,972,998	-	(20,587,048)
OTHR	(8,537,178)	14,733,615	(594,891)	(8,384,467)	(2,027,875)	(2,124,927)	-	(138,533,853)		(145,469,576)
PCOD	(66,716,254)	(47,776,374)	(9,550,795)		-	(3,837,598)		5,689,622		(122,191,399)
PLCK	(28,229,659)	(2,609,946)	(68,122,374)			(5,465,041)		(9,737,157)		(114,164,177)
ROCK	(24,474)	(3,631,789)	37,316		-	5,777,305		(125,945)		2,032,413
SABL	(14,281,920)	(177,382)	2,577,499		-	(6,800,359)		(50,809,328)		(69,491,490)
SLMN	(255,260,513)	(43,284,255)		(128,588,163)	(32,078,431)	4,313,106	15,625,368	(166,939,218)		(606,212,106)
TCRB	(12,447,856)	(90,194)	(34,706,828)			9,029,073		(8,954,608)		(47,170,413)
Grand Total	**(409,040,510)**	**(120,424,908)**	**(103,134,105)**	**(136,967,950)**	**(34,106,306)**	**(11,552,491)**	**15,625,368**	**(405,698,744)**	**-**	**(1,205,299,646)**

Table A6. Detailed economic impacts (quantity change)

Industry / species/ sector	AT-SEA	AWCA	AEB	LPB	BBB	DCA	KIB	RAK	WOC	Rest of US
INDUSTRY OUTPUT ($million)										
HARVESTING										
KCRB	0.0	18.5	-13.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
TCRB	0.0	-26.7	-7.4	0.0	0.0	0.0	3.3	0.0	0.0	0.0
OCRB	0.0	-1.0	4.3	0.0	0.0	0.0	-1.8	0.0	0.0	0.0
PCOD	24.6	-2.1	-8.6	0.0	0.0	0.0	-3.8	0.0	0.0	0.0
PLCK	19.6	-16.4	-25.7	0.0	0.0	0.0	-4.8	0.0	0.0	0.0
SABL	1.8	-0.2	-18.2	0.0	0.0	0.0	-10.0	0.0	0.0	0.0
ROCK	7.5	0.1	0.2	0.0	0.0	0.0	2.8	0.0	0.0	0.0

FLTF	-21.2	0.1	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0
SLMN	0.0	0.0	-60.0	-24.3	-243.0	-42.0	-16.6	0.0	0.0	0.0
HLBT	0.0	-0.9	-3.5	0.0	0.0	0.0	-9.9	0.0	0.0	0.0
OTHR	4.9	0.6	0.4	0.0	0.0	-0.2	1.6	0.0	0.0	0.0
Harvest in RAK, WOC, and Rest of US	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-138.6	0.0	0.0
TOTAL HARVESTING	37.25	-27.97	-131.32	-24.35	-243.00	-42.28	-38.91	-138.6	0.0	0.0
PROCESSING										
KCRB	0.0	9.6	6.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TCRB	0.0	-34.7	-12.4	0.0	0.0	0.0	9.0	0.0	0.0	0.0
OCRB	0.0	-3.1	-15.2	0.0	0.0	0.0	-6.8	0.0	0.0	0.0
PCOD	-47.8	-9.6	-66.7	0.0	0.0	0.0	-3.8	0.0	0.0	0.0
PLCK	-2.6	-68.1	-28.2	0.0	0.0	0.0	-5.5	0.0	0.0	0.0

SABL	-0.2	2.6	-14.3	0.0	0.0	0.0	-6.8	0.0	0.0	0.0
ROCK	-3.6	0.0	0.0	0.0	0.0	0.0	5.8	0.0	0.0	0.0
FLTF	-41.3	-0.4	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0
SLMN	0.0	0.0	-255.3	15.6	-128.6	-32.1	4.3	0.0	0.0	0.0
HLBT	0.0	1.1	-15.1	0.0	0.0	0.0	-7.2	0.0	0.0	0.0
OTHR	14.7	-0.6	-8.5	0.0	0.0	-2.0	-2.2	0.0	0.0	0.0
Processing in RAK, WOC, and Rest of US	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-405.8	0.0	0.0
TOTAL PROCESSING	-80.84	-103.13	-409.04	15.63	-128.59	-34.11	-11.64	-405.79	-0.01	0.00
SEAFOOD TOTAL	-43.59	-131.11	-540.36	-8.72	-371.59	-76.39	-50.55	-544.41	-0.01	0.00
NON-SEAFOOD TOTAL	0.00	-14.01	-32.70	-1.83	-32.04	-15.59	-15.60	-550.24	-679.81	-1199.17
TOTAL ALL INDUSTRIES	-43.59	-145.12	-573.06	-10.56	-403.63	-91.97	-66.15	-1094.65	-679.82	-1199.17

EMPLOYMENT (Total workers / jobs)										
HARVESTING										
KCRB	0	91	-63	0	0	0	0	0	0	0
TCRB	0	-130	-36	0	0	0	16	0	0	0
OCRB	0	-5	109	0	0	0	-15	0	0	0
PCOD	127	-28	-124	0	0	0	-61	0	0	0
PLCK	116	-54	-95	0	0	0	-19	0	0	0
SABL	9	-4	-422	0	0	0	-199	0	0	0
ROCK	39	2	5	0	0	0	13	0	0	0
FLTF	-110	0	1	0	0	0	1	0	0	0
SLMN	0	0	-1667	-786	-7768	-1241	-677	0	0	0
HLBT	0	-23	-89	0	0	-1	-235	0	0	0

OTHR	25	9	2	0	0	-7	38	0	0	0
Harvesting in RAK, WOC, and Rest of US	0	0	0	0	0	0	0	-2663	0	0
TOTAL HARVESTING	208	-141	-2379	-786	-7768	-1249	-1138	-2663	0	0
PROCESSING										
KCRB	0	69	57	0	0	0	0	0	0	0
TCRB	0	-250	-106	0	0	0	88	0	0	0
OCRB	0	-22	-129	0	0	0	-66	0	0	0
PCOD	-314	-69	-566	0	0	0	-37	0	0	0
PLCK	-16	-491	-239	0	0	0	-53	0	0	0
SABL	-1	19	-121	0	0	0	-66	0	0	0
ROCK	-24	0	0	0	0	0	56	0	0	0
FLTF	-272	-3	0	0	0	0	15	0	0	0

SLMN	0	0	-2165	391	-1660	-817	42	0	0	0
HLBT	0	8	-128	0	0	0	-71	0	0	0
OTHR	97	-4	-72	0	0	-52	-22	0	0	0
Processing in RAK, WOC, and Rest of US	0	0	0	0	0	0	0	-1295	0	0
TOTAL PROCESSING	-530	-743	-3470	391	-1660	-868	-114	-1295	0	0
SEAFOOD TOTAL	-322	-884	-5849	-395	-9428	-2117	-1251	-3958	0	0
NON-SEAFOOD TOTAL	0	-76	-187	-14	-285	-113	-115	-2994	-3770	-6482
TOTAL ALL INDUSTRIES	-322	-961	-6036	-409	-9713	-2231	-1367	-6952	-3770	-6482
VALUE ADDED ($ million)										
LABOR INCOME-Seafood sectors	-2.00	-27.55	-94.68	-8.15	-77.63	-18.90	-16.57	-93.65	-111.10	-42.31

LABOR INCOME – Non-seafood sectors	0.00	-5.14	-8.43	-0.75	-8.09	-5.42	-4.75	-163.90	-208.29	-328.96
Proprietary income – Seafood sectors	0.05	-19.45	-155.35	-22.85	-152.38	-47.57	-31.20	-122.72	-128.18	-95.91
Proprietary income – Non-seafood sectors	0.00	-0.45	-0.24	-0.02	-0.97	-0.30	-0.47	-23.38	-29.28	-48.60
Other property income	0.00	-3.07	-6.29	-0.59	-4.36	-2.72	-3.74	-126.30	-135.59	-210.02
Indirect business tax	-0.71	-3.77	-11.37	0.38	-6.12	-1.80	-0.80	-90.05	-28.95	-45.05
TOTAL VALUE ADDED	-2.66	-59.42	-276.37	-31.97	-249.56	-76.70	-57.53	-620.01	-641.40	-770.86
HOUSEHOLD INCOME ($ million)										
Low income households	0.00	-0.16	-0.51	-0.23	-0.12	-0.40	-0.27	-4.90	-8.65	-13.05
Medium income households	0.00	-2.01	-8.61	-2.91	-3.74	-4.67	-3.65	-62.10	-80.57	-120.09
High income households	0.00	-14.33	-28.79	-10.82	-23.77	-18.43	-15.81	-314.70	-350.69	-384.43

TOTAL HOUSEHOLD INCOME	0.00	-16.50	-37.91	-13.96	-27.64	-23.51	-19.72	-381.70	-439.91	-517.57
STATE AND LOCAL GOV'T REVENUE ($million)										
State and local govt revenue	0.00	-3.64	-7.91	0.17	-5.77	-3.78	-1.60	-110.80	-58.34	-77.70

A.8 U.S. seafood export effective exchange rate

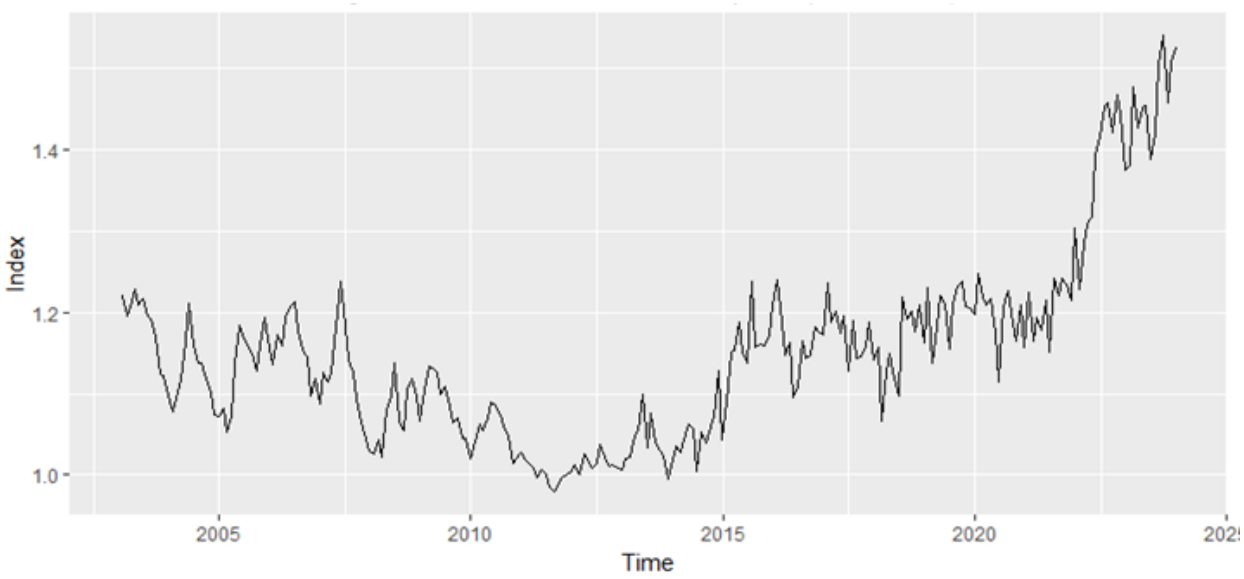

Figure A10. Real effective exchange rate for Alaska seafood exports (2003-2023)

A.9 References

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