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Annual Community Engagement and Participation Overview

An annual report focusing on sustained participation of those fishing communities substantially dependent on or substantially engaged in the North Pacific groundfish and crab fisheries.

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Alaska Fisheries Science Center

Economic and Social Science Program

ANNUAL COMMUNITY ENGAGEMENT AND PARTICIPATION OVERVIEW

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Fishing Communities in Alaska

Fishing in Alaska contributes to local and State economies, cultural cohesion, and food security within Alaska and beyond. The hundreds of communities in Alaska involved in commercial, recreational, and subsistence fishing contribute to community wellbeing and economic livelihoods, and support meaningful ways of life for Alaskans. The Annual Community Engagement and Participation Overview (ACEPO) presents social and economic information for those communities substantially engaged in the commercial Fishery Management Plan (FMP) groundfish and crab fisheries in Alaska. ACEPO is a community level analysis guided by The North Pacific Fishery Management Council (Council) management objectives and Magnuson–Stevens Fishery Conservation and Management Act (MSA) National Standard 8 (NS8).

This document provides information on the social and economic benefits of FMP groundfish and crab fisheries. This objective is in line with MSA-NS8 which calls for the sustained participation and the minimization of adverse economic impacts for fishing communities. Economic and social benefits to fishing communities are tied to economic stability and community wellbeing. In line with MSA-NS8, the Council has identified seven management objectives, one of which is maximizing the economic and social benefits of fisheries to the nation over time (Crab FMP 7.2.2). These benefits include, but are not limited to: profits, income, employment, benefits to consumers, and "less tangible or less quantifiable social benefits such as the economic stability of coastal communities."

To support these management objects and MSA-NS8, the Alaska Fisheries Science Center (AFSC) developed ACEPO to provide an annual overview of community engagement. ACEPO will be updated annually and can be expanded to include more detailed information as needed. Alaska communities were examined within the context of their geographic place, as well as historical and current fishing involvement in Alaska's groundfish and crab fisheries. This analysis considers four performance metrics of commercial fisheries participation to understand the different ways that communities are involved in FMP groundfish and crab fisheries: 1) commercial processing engagement, 2) commercial harvesting engagement, 3) the processing regional quotient which measures the percentage of all FMP groundfish and crab landings occurring in each community, and 4) the harvesting regional quotient that measures the percentage of all FMP groundfish and crab landings revenue attributable to vessels owned by residents of each community.

In addition to the engagement indices, this report also considers communities' engagement and reliance on subsistence harvests from these fisheries as well as the impacts of various ecological and social stressors, particularly climate change, on community wellbeing and communities' capacities to adapt to these changes. Together, these indicators provide a quantitative measure of community participation in Alaska fisheries and how their participation has changed from 2008 through 2021, as well as insights into how other forms of participation in these fisheries and the vast ecological changes occurring in Alaska affect the economic, social, and cultural wellbeing of these communities.

This document is divided into four sections to provide a multi-scaled synopsis of groundfish and crab fisheries engagement. Section I addresses the definition of fishing communities as provided in the MSA, and describes the social and economic benefits associated with participation in the FMP groundfish and crab fisheries. It details the method and criteria used to develop the Community Fisheries Participation Indices for Alaska communities, and to identify substantially engaged communities, as well as the importance of subsistence fishing and the impacts of climate change on the food security of these communities. Sections II and III present an overview of both groundfish and crab fisheries in relation to associated community level benefit. These sections identify which communities participate in FMP groundfish and crab fisheries, along with observable trends in participation. A general overview of crab and groundfish fisheries within Alaska is provided here in order to locate this analysis in historical and regulatory context. Section IV is dedicated to the individual Community Sketches created for each community identified as substantially engaged in the FMP groundfish and/or crab fisheries. The sketches offer a deep dive into community participation in fisheries and provide vital context to better understand possible social benefits.

For the purpose of this annual report, to be consistent with Council management concerns, the existing database of community data was used including communities outside Alaska. The analysis focused only on commercial FMP groundfish and crab fisheries from 2008-2021, to maximize the best available data. It is worth noting that this report is not an exhaustive account of communities substantially engaged or dependent on fishing to support livelihoods and way of life; however, ACEPO provides an overview of select communities that are identified as highly engaged through quantifiable select criteria (see the methods section for further details).

The Importance of Human Communities

National Standard 8 of the Magnuson Stevens Act (MSA) states that management and conservation measures shall, "take into account the importance of fishery resources to fishing communities in order to: (1) Provide for the sustained participation of such communities; and (2) To the extent practicable, minimize adverse economic impacts on such communities." The term "fishing community," is defined as, "a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community." While the MSA defines and requires consideration of fishing communities, what constitutes a fishing community in practice is complex and has long been debated.

Communities are diverse. For the sake of consistency, this overview follows NMFS' interpretation of the term fishing community to mean, "a social or economic group whose members reside in a specific location…" As community level analyses continue to develop further, it should be recognized that the concept of community may shift within differing contexts and perspectives. While geographic location may be relatively easy to determine, defining fishing communities solely on geography risks overlooking social processes that are valuable to understanding social complexity, including social networks valuable to the flow of people, information, goods, and services. In light of the variations in use in marine spaces across different social groups, it is vital that the parameters of what constitutes a fishing community are thoughtful and specific. Some managers have turned to, "multiple constructions of communities," to better understand fishing communities. Others expand the concept of, "community," to include those areas, resources, and social networks on which people depend. The move toward ecosystem-based management within Federal fisheries may suggest greater consideration of, "community-level processes, practices, interactions and interdependencies as starting points for understanding the relationship between the rich and complex social practice of fishing and marine ecosystems." While the communities identified in ACEPO are defined by geographic location, we consider the level of participation in direct harvest, post-harvest processing, and associated community benefits in order to capture the linkages among people engaged in groundfish and crab fisheries, as well as the social and economic impacts on communities of place.

Scientific and Statistical Committee comments

ACEPO was developed in response to requests from NPFMC for community-level information for the groundfish and crab fisheries. ACEPO provides specific fisheries data relevant to sustained participation in specific fisheries as well as broader community engagement and wellbeing to facilitate contextualized decision making by the Council.

SECTION I: Community Participation Indices

The ACEPO analysis considers four performance metrics of community fisheries participation to understand the different ways that communities are involved in Alaska fisheries: commercial processing engagement, commercial harvesting engagement, the processing regional quotient which measures the percentage of all Alaska commercial landings within the specific FMPs occurring in each community, and the harvesting regional quotient that measures the percentage of all Alaska landings attributable to vessels owned by residents of each community. Time series summary tables of these four metrics provide a quantitative measure of community participation in Alaska commercial fisheries and how that participation may have changed from 2008 through 2021, the most recent available data. The Community Participation Indices are relative, in that each community's level of engagement is dependent on the other communities included in the analysis, which in this case includes eight non-Alaska community groupings: Bellingham, WA; Other Washington; Newport, OR; Other Oregon; All California; All Other States; the At-Sea Processor grouping; and the Seattle metropolitan statistical area (Seattle MSA) which includes Seattle, Tacoma, and Bellevue. These groupings were chosen to maintain consistency with Council analyses.

By examining fishing community participation over time, it is possible to trace sustained participation in specific fisheries, as well as flag changes in participation for some communities. Further research may then clarify some of the drivers of these changes. ACEPO presents an overview of communities substantially engaged in FMP groundfish and crab fisheries, and highlights those communities highly engaged according to the established criteria. Due to the differences in the overall fisheries framework, involvement in CDQ programs was not among the criteria used to identify communities.

Note on Confidentiality

Due to the small number of reporting entities, some results are suppressed to protect the confidentiality of proprietary information. For example, confidentiality concerns required that Akutan, Sand Point, and King Cove's fishing engagement data be aggregated to avoid disclosure of confidential information. For that reason, the Akutan community sketch provides information specific to the community of Akutan, but presents aggregated fishing data from Akutan, King Cove, and Sand Point communities.

Additional data about those communities are provided in order to offer valuable rich context and best available science to inform decision making. The dataset includes data on Alaska commercial fishing activities from 2008-2021 for all communities in the U.S. In line with continued efforts to increase relevance, we could expand to include additional information in the future.

In response to comments from the SSC, the analysis presented here remains limited to participation in the commercial processing and harvesting sectors in North Pacific fisheries groundfish and crab FMP fisheries. If interest grows, additional fisheries can be added to the analysis. Effort was made to provide most relevant fisheries data while adhering to confidentiality constraints. Most communities that emerged were discrete entities; however Kodiak Island Borough (KIB) was analyzed on the borough level separately from the City of Kodiak in order to reflect the significance of smaller communities on Kodiak Island, which may otherwise be obscured. For communities where the small number participating entities requires the suppression of individual statistics, reasons for data aggregation are noted.

Several assumptions were made within this analysis. Vessels were assigned to the community based upon the ownership address listed in the Alaska Commercial Fisheries Entry Commission (CFEC) registry. Vessel ownership can be dynamic; and there are multiple reasons for registration practices that may not relate to residency of owner(s). Permit information was assigned when possible. Given a mobile workforce and possibility of multiple home ports, these indicators only allow for a partial understanding of the flow of economic and social benefits associated with individuals and vessels. Shoreside processors were associated with geographic location although it is understood that economic benefits likely extend beyond one geographic community.

Commercial Fisheries Engagement Indices

The study population includes communities with any shoreside landings for FMP groundfish and both at-sea and shoreside landings for FMP crab; and communities with residents owning vessels that fished in those fisheries. Communities were included if they had shoreside landings for any year from 2008-2021 or residents owning vessels that fished in any year from 2008-2021. At this time, the engagement indices exclude inshore floating processors and any landings where the landing port is unknown or missing. The groundfish engagement indices also exclude the at-sea processing landings. The analysis separates variables into two categories of fisheries involvement: commercial processing and commercial harvesting for each FMP. Processing engagement is represented by the amount of landings and associated revenues from landings in the community, the number of vessels delivering any FMP groundfish or crab in the community, and the number of processors in the community processing any FMP groundfish or crab. Harvesting engagement is represented by: the FMP groundfish and crab landings, revenues associated with vessels owned by community residents, the number of vessels with FMP groundfish or crab landings owned by residents in the community, and the number of distinct resident vessel owners whose vessels made FMP groundfish or crab landings in any community. By separating commercial processing from commercial harvesting, the engagement indices highlight the importance of fisheries in communities that may not have a significant amount of landings or processing in their community, but have a large number of fishers and/or vessel owners that participate in commercial fisheries who are based in the community.

To examine the relative harvesting and processing engagement of each community, a separate principal components factor analysis (PCFA) was conducted each year for each category to determine a community's engagement relative to all other Alaska communities. Two PCFAs are conducted (processing engagement and harvesting engagement) each year for 14 years (total of 24 PCFAs). PCFA is a variable reduction strategy that separates a large number of correlated variables into a set of fewer, linearly independent components. These components are used to create quantitative indices of engagement for each community by using the regression method of summing the standardized coefficient scores multiplied by the included variable values. A unique processing index and harvesting index value for each community in each year is created using the first un-rotated extracted factor from the PCFA, each of which resulted in single factor solutions with second factor eigenvalues below 1.00 for all 24 PCFAs. Each index is normalized to have a mean of zero and a standard deviation of one. These indices are relative scores: they represent each community's engagement in commercial fisheries relative to all other communities in that year. Indices are then combined across all years to create a time series of relative engagement over time. Communities that scored above one (above one standard deviation from the mean of zero) for any year are classified as *Highly Engaged* for that year. Communities that were *Highly Engaged* in all 14 years from 2008-2021 were used in additional analyses to explore the changes in their fisheries participation in processing engagement or harvesting engagement.

These are relative indices: a large change in the total number of active vessels over time will only cause a change in an index if one community loses a larger share of their vessels (or other commercial fisheries activities) than another community. If the change in number of active vessels (or other commercial fishing activities) are directly proportional to the existing number of vessels across communities, there will not be a change in the indices.

Regional Quotient

The regional quotient (RQ) measures the share of a particular fishery landed in specific communities in relation to all Alaska FMP fisheries. This metric is meant to reflect a community's degree of involvement (as measured by fisheries landings) in a select fishery, in both the harvesting and processing sectors. The RQ is calculated as the landings or revenue attributable to a community divided by the total landings or revenue from all communities. To reflect each community's share of landings or revenue of the total groundfish or crab fisheries, the RQ takes into account landings in the at-sea sector (catcher processors and motherships) and at inshore floating processors, and treats the "at-sea" group as a separate community of practice. Calculated separately for the dimensions of processing engagement and harvesting engagement, the RQ uses the same criteria for inclusion as the commercial fisheries engagement indices (2008-2021).

Climate Change Effects on Fishing Communities

Climate change is currently affecting Alaskan communities in increasingly disruptive ways. Alaska air temperature is currently warming twice as fast as the global average, and has already experienced more record high temperatures in the last decade than ever before. Under a higher warming scenario, the average high temperature is predicted to increase by 4 to 8 degrees in the summer, and 10 degrees in the winter. Increased precipitation is also predicted to occur in all areas of the state. Marine heatwaves, reduced sea ice, sea level rise and flooding, toxic algal blooms, thawing permafrost and ocean acidification are some of the most significant consequences occurring due to these climatic changes.[1]

These climate driven events are having profound effects on fisheries and the communities that rely on them. For instance, in 2014-2016, an unprecedented warming event in the North Pacific Ocean drastically reduced the abundance of Pacific cod in the Gulf of Alaska. Communities dependent on this fishery incurred substantial loss in catch and revenue with little time to prepare[2]. Warming ocean temperatures have also led to changes in abundance and distribution of many groundfish and crab species,[3,4,5] as well as marine mammals. Recent Federal fisheries disasters are almost exclusively attributed to extreme environmental events such as these, resulting in billions of revenue loss for the federal government and direct revenue loss from the fishing industry.[6] There is a need to understand how these changes will affect fisheries and fishing communities. Beyond these impacts, many community members are also observing additional ecological changes based on their own Local and Traditional Knowledge of the area. These observations are vital to understand broad longitudinal patterns, particularly in data limited areas.[7,8] (For examples of how Local Knowledge has informed Federal management for certain data-poor fisheries, see rockfish,[10] and Dungeness crab [11] examples.)

The effects of climate change and other disruptions (such as the Covid-19 pandemic) affect the vulnerability and resilience of communities in different ways. The increased frequency of disasters are exacerbating the impacts of individual events and compounding risk to communities.[7,8] Risks exist in tandem with climatic and ecological changes and compound them. Community climate vulnerability assessment is the analysis of expected climate impacts, risk, and adaptive capacity. Climate vulnerability is the degree to which a community is at risk of exposure to the biophysical effects of climate change, such as sea level rise or storm events.

In addition, the extent to which a community depends on particular marine resources impacted by climate change (whether in the commercial, recreational, or subsistence sectors) affects community vulnerability and risk. Finally, a community's adaptive capacity to offset the impacts of climate change can vary based on income level, economic diversity, education level, and population composition.[11] Adaptive capacity is informed by robust knowledge systems, strong social networks, and economic and institutional support.[12] Others also include aspects such as infrastructure, technology, social capital, and good governance.[13,14, 15]

Each community sketch will include discussions of how that community is being impacted by climatic changes, including through fisheries closures, as well as their potential adaptive capacity and risk level given many of the factors outlined here.

The Effects of COVID-19 Pandemic on Alaska Fishing Communities

The COVID-19 public health crisis that began in 2019 has significantly affected commercial, recreational, and subsistence fisheries.[xx] For example, commercial fishing operations across the U.S. faced major landings revenue losses, processing plant closures, disrupted supply chains, shifts in the seafood market, and shortened fishing seasons.[16,17] In Alaska, commercial fishers reported a range of negative effects from COVID-19 including: reduction in the volume of fish harvested as well as ex-vessel prices, disruptions in business planning and logistics, and labor shortages.[xx] Costs for processor operations increased as a result of COVID-19, and the number of crew licenses decreased by 21% from 2019 to 2020.[18] Subsistence and recreational fishers were affected by similar issues. Under Covid-19 restrictions, subsistence fishers were unable to fish with their usual crew which limited how often and where people chose to fish. Within this broader context, highly engaged communities in federal groundfish and crab fisheries experienced decreased school enrollment between 2019 and 2020 and decreased tax revenue across communities. Many also experienced decreases in pounds landed and the number of active vessels in 2020, although much of that rebounded in 2021.

Overall, $300 million in CARES Act funds were reserved for Alaska's fisheries sector, including $2.4 million for subsistence users and low income fishers who were impacted.[19] The community sketches highlight some of the impacts of Covid-19 on communities to provide some context; however, additional research would inform understanding the effects of the pandemic and distribution of CARES Act funds within these communities and across Alaska.

Subsistence Fishing and Food Security

Alaska fisheries provide food for the United States and beyond. In addition to that, Alaska communities rely on a range of marine resources for subsistence uses which have significant social, cultural, and economic value for people. Alaska Natives have harvested and shared traditional foods for thousands of years and doing so is vital to their physical, mental, and spiritual wellbeing.[1,2] Given the importance of subsistence to Alaskans and Native Alaskan way of life, additional information is included in ACEPO to provide context.

In 1978, the State of Alaska enacted its first subsistence law that prioritized subsistence over recreational and commercial uses. In 1990, the Federal government began managing subsistence hunting, trapping, and fishing on Alaska's Federal public lands and non-navigable waters.[3,4]

Subsistence fishing supports the food security and sovereignty of many households through the nutritional, economic, and cultural benefits provided. Economically, subsistence practices provide critical nutritional requirements for many rural residents.[5] Furthermore, the cost of foods to replace subsistence fisheries represents a substantial portion of household income.[2] Traditional foods and the sharing of subsistence harvests are tied to cultural identity and social networks, such as family and community ties[7,8].

Food security exists, "when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences in order to lead a healthy and active life."[20] Food sovereignty is a complementary concept to food security and describes, "the right of Peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems."[6] Maintaining both food security and sovereignty can help communities be more resilient to stressors, including climate change and large social disruptions, such as the COVID-19 pandemic, by ensuring that communities can still access sufficient nutritious food when global supply chains are disrupted or ecological changes impact certain sectors.

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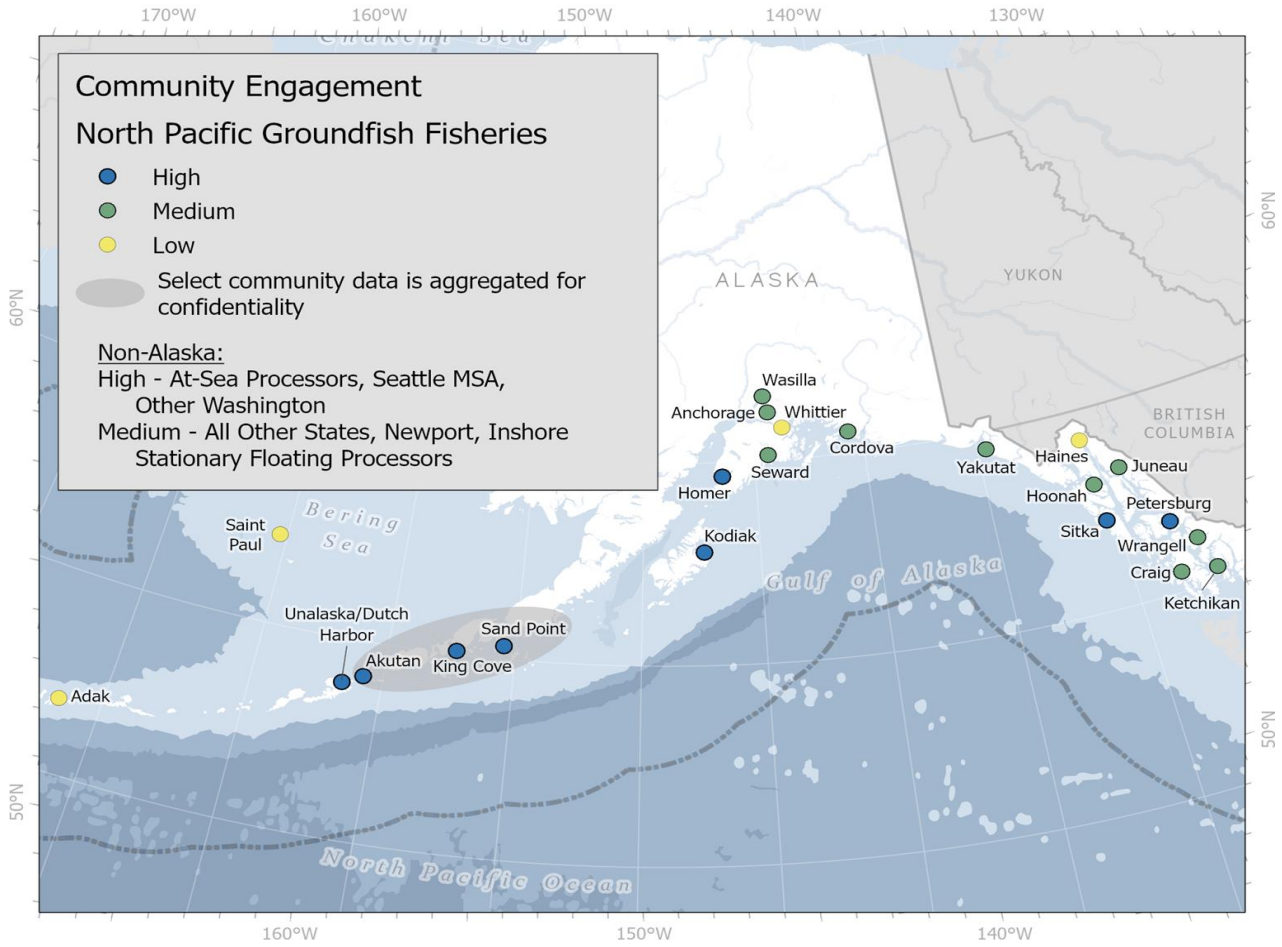
SECTION II: Community Participation in North Pacific Groundfish Fisheries



Alaska FMP Groundfish Fisheries

The North Pacific region's commercial fisheries have transformed over time with changing technology, labor, market demand, and legislation. The earliest commercial fishing efforts by U.S. vessels in waters off the coast of Alaska emerged in the 1860s, primarily targeting Pacific cod. With the development of diesel engines, commercial fisheries for Pacific halibut and groundfish expanded north to the Gulf of Alaska (Gulf) and into the Bering Sea (BS) region by the 1920s. By the mid-1900s, fisheries had developed for a variety of groundfish species. Groundfish fisheries changed dramatically in the wake of World War II as Alaskan commercial fisheries expanded and industrialized. From the end of World War II to the introduction of the Exclusive Economic Zone under the Magnuson-Stevens Act (MSA), the North Pacific region's harvests increased substantially. The greatest increase was in the groundfish and crab sectors in the Bering Sea Aleutian Islands (BSAI) and Gulf. Groundfish harvests grew to exceed 2 million tons (mt) per year in the early 1970s. Technological developments and changes in marketing continued to increase harvests, leading to some concern of overexploitation, particularly by foreign fleets. The 1945 Truman Proclamation stressed the U.S.'s right to manage and conserve living marine resources in these areas and to require foreign compliance.[8] This claim was not effectively exercised until the MSA was implemented in 1977. The MSA has been amended over the years, most substantially in 1996 with the Sustainable Fisheries Act, and in 2006 with the Reauthorization Act. The Sustaining America's Fisheries for the Future Act is currently being considered in Congress.

Commercial Groundfish Harvesting Engagement

Data were collected for 103 communities or community groupings throughout the U.S. to create performance metrics of community participation in Alaska groundfish FMP fisheries from 2008-2021. Communities were included if they had either some commercial BSAI or Gulf FMP groundfish fisheries landings or residents who owned vessels used in commercial BSAI or Gulf FMP groundfish fishing during this time period. Of these 103 communities, 60 had some groundfish landings in their community while 93 had a resident who owned a vessel that participated in commercial groundfish harvest. All 103 communities were included in both the commercial harvesting and processing engagement index. The results of the commercial harvesting engagement PCFA analyses are shown here in Table 1, which presents the eigenvalues, factor loadings, total variance explained, and Armor's theta reliability coefficient cited for all variables. The results suggest fairly strong relationships among variables, and that a single index based on the first extracted factor explains over 78% of the variation in each of the variables in each year. Figure 3 displays the aggregate annual values of the four variables that make up the harvesting engagement index for each year to better understand the absolute changes in North Pacific groundfish harvesting activities that are underlying the relative harvesting engagement index. Aggregate revenues and pounds landed were both down 17% and 9%, respectively, in 2021 compared with their 2016-2020 average while being harvested by 10% fewer vessels, which were owned by 11% fewer individuals.

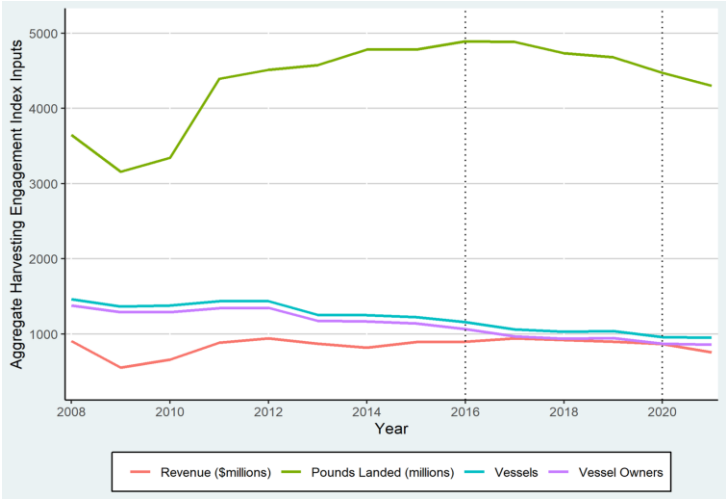


Figure 3. Aggregate annual Groundfish Harvesting Engagement Index inputs. Dotted lines indicate the previous 5 year period (2016-2020).

Table 1. Commercial harvesting engagement PCFA results 2008 – 2021.

YEAR	Eigenvalues				Factor Loadings				Percent variance explained	Armor's Theta
	1	2	3	4	Ex-vessel value from vessel owners	Pounds landed by vessel owners	Total # fishing vessels	Total # of unique vessel owners		
2008	3.27	0.73	0.00	0.00	0.91	0.90	0.92	0.89	82%	0.93
2009	3.20	0.80	0.00	0.00	0.91	0.88	0.91	0.87	80%	0.92
2010	3.17	0.83	0.00	0.00	0.90	0.88	0.91	0.87	79%	0.91
2011	3.13	0.87	0.00	0.00	0.90	0.87	0.90	0.87	78%	0.91
2012	3.13	0.87	0.00	0.00	0.89	0.88	0.90	0.86	78%	0.91
2013	3.22	0.78	0.00	0.00	0.91	0.89	0.92	0.87	81%	0.92
2014	3.19	0.81	0.00	0.00	0.90	0.89	0.91	0.87	80%	0.91
2015	3.19	0.81	0.00	0.00	0.90	0.89	0.91	0.87	80%	0.92
2016	3.23	0.77	0.00	0.00	0.91	0.90	0.93	0.87	81%	0.92
2017	3.31	0.69	0.00	0.00	0.92	0.90	0.94	0.88	83%	0.93
2018	3.29	0.71	0.00	0.00	0.92	0.90	0.94	0.87	82%	0.93
2019	3.26	0.74	0.00	0.00	0.91	0.90	0.93	0.87	82%	0.92
2020	3.27	0.73	0.00	0.00	0.91	0.90	0.93	0.87	82%	0.93
2021	3.21	0.79	0.00	0.00	0.91	0.89	0.92	0.86	80%	0.92

Commercial Groundfish Harvesting Engagement

Table 2. Index scores of communities highly engaged in commercial harvest of Groundfish 2008 – 2021.

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Homer	1.18	1.32	1.44	1.41	1.50	1.53	1.46	1.64	1.74	1.83	1.85	1.80	1.69	2.10
Kodiak	2.66	2.76	2.86	3.33	3.16	2.45	2.65	3.01	3.02	2.27	2.01	2.12	2.00	2.23
Other Washington	1.37	1.30	1.23	1.12	1.08	1.12	1.11	1.04	1.04	1.01	1.19	1.20	1.23	1.11
Petersburg	1.50	1.40	1.60	1.33	1.38	1.46	1.53	1.54	1.55	1.68	1.65	1.77	1.74	1.88
Seattle MSA	8.78	8.65	8.56	8.48	8.51	8.73	8.62	8.61	8.70	8.83	8.83	8.78	8.82	8.70
Sitka	2.36	2.78	2.79	2.70	2.73	2.76	2.89	2.43	2.05	2.31	2.38	2.43	2.47	2.26

*Shaded cells are index scores above one (one standard deviation above the mean of zero) for at least one year (2008-2021).

In addition to the goodness of fit statistics of the analyses provided in Table 1, each PCFA provides an index score for each of the 103 communities included in the harvesting engagement analyses. Table 2 displays commercial groundfish harvesting engagement index results for the six communities that were highly engaged in FMP groundfish harvesting for at least one year between 2008-2021. Communities are defined as highly engaged when their index score is above one, or one standard deviation above the mean of zero.

The harvesting engagement index is a relative indicator of community participation compared to the participation of all other communities that harvest BSAI and Gulf FMP groundfish. It measures the presence of commercial fishing participation through residents who own commercial fishing vessels that are active in FMP groundfish fisheries. Variables included in the index are pounds landed and revenue by resident vessel owners, the number of active vessels, and the number of unique vessel owners in the community.

All six community groupings listed in Table 2 were Highly Engaged in commercial harvesting in all years from 2008-2021: Homer, Kodiak, Petersburg, Sitka, Seattle MSA, and Other Washington communities. Seattle MSA has by far the highest degree of engagement over time, with fairly consistent index scores from 2008-2021. Aside from Seattle MSA, Kodiak and Sitka have the highest engagement scores over time. Between 2020 and 2021, Sitka, Seattle MSA, and Other Washington experienced slight declines in index scores, while Homer, Kodiak, and Petersburg experienced slight increases in index scores (Figure 4).

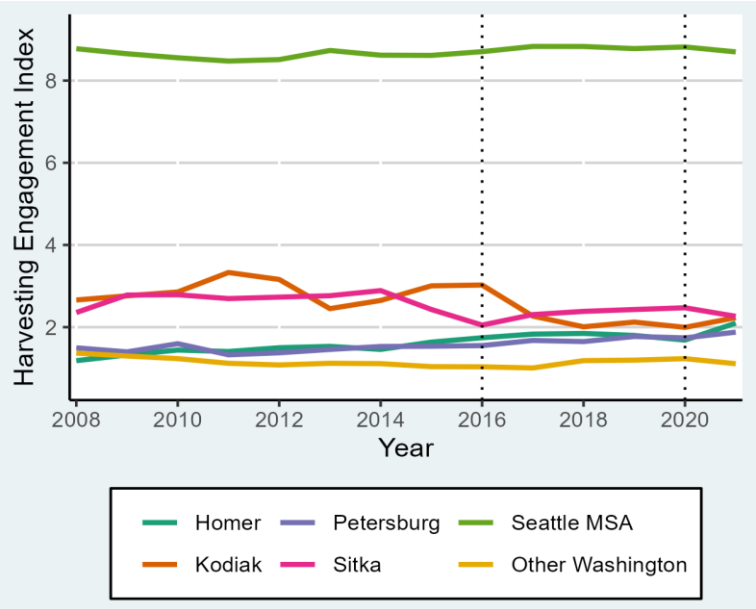


Figure 4. Index scores of communities highly engaged in commercial harvest for at least 1 year from 2009-2021. Dotted lines indicate the previous 5 year period (2016-2020).

Harvesting Regional Quotient

The commercial harvesting Regional Quotient (RQ) is associated with a community's resident vessel owners to account for where shares of fishing revenue enter the local economy. Figure 5 shows the harvesting RQ for North Pacific groundfish revenue from 2008-2021. The RQ indicates the percentage contribution in revenue of FMP groundfish from resident vessel owners in a community relative to the total (shore-based and at-sea) revenue from BSAI and Gulf FMP groundfish fisheries.

The community with the largest share of harvesting vessel owners is the Seattle MSA, which averages 70% of harvesting vessel ownership. The Other Communities grouping represents the second largest share at 14% of vessel owners. Kodiak and Other Washington have 5% of the share of the ownership of North Pacific groundfish harvesting vessels. The other highly engaged communities include Petersburg, Sitka, and Homer, which represented 1.8%, 1.6%, and 1.4% of total FMP groundfish vessel owner revenues, respectively. These three communities have also seen the largest increase in harvesting RQ in 2021 compared with the 2016-2020 average at 17%, 18%, and 29%, respectively. Kodiak experienced an 8% decline, while the Seattle MSA experienced a 3% decline compared with a 5% increase in All Other Washington, and a 9% increase in All Other Communities.

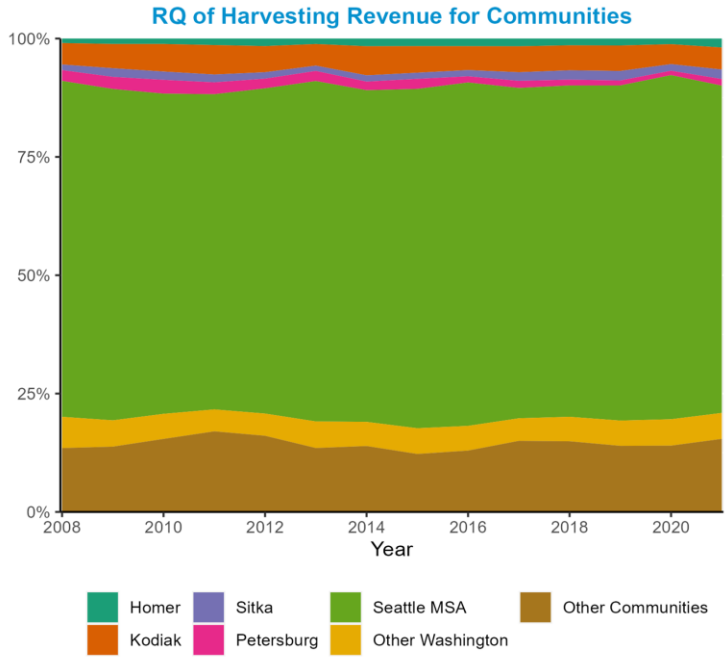


Figure 5. Harvesting regional quotient of revenue for communities highly engaged in commercial harvesting for all years from 2008-2021.

Commercial Processing Engagement

The results of the commercial processing engagement PCFA analyses are shown in Table 3, which presents the eigenvalues, factor loadings, total variance explained, and Armor's theta reliability coefficient (Armor, 1974) for all of the variables included in each PCFA. Vessel deliveries and landings were used as a proxy metric for processing engagement. The results suggest strong relationships among variables and that a single index based on the first extracted factor explains over 78% of the variation in each of the variables in each year. In addition to the goodness of fit statistics of the analyses provided in Table 3, each PCFA provides an index score for each of the 60 communities included in the analyses.

The commercial processing engagement index is a relative indicator of community participation compared to the participation of all other communities that process BSAI and Gulf FMP groundfish. Figure 6 displays the aggregate annual values of the four variables that make up the processing engagement index for each year to better understand the absolute changes in North Pacific groundfish processing activities that are underlying the relative processing engagement index. As with the harvesting engagement indices, aggregate revenues and pounds landed were both down 17% and 9%, respectively, in 2021 compared to their 2016-2020 average. The number of unique vessels delivering to ports as well as the number of processing entities declined by 6% in 2021 compared with the average of the 2016-2020 period.

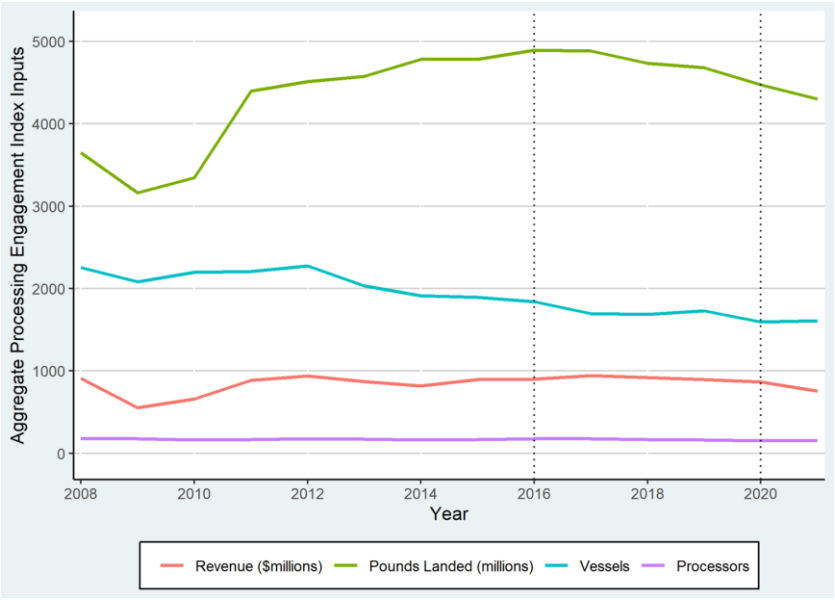


Figure 6. Aggregate annual Groundfish Processing Engagement Index inputs. Dotted lines indicate the previous 5 year period (2016-2020).

Table 3. Commercial processing engagement PCFA results

YEAR	Eigenvalues				Factor Loadings				Percent variance explained	Armor's Theta
	1	2	3	4	Ex-vessel value	Pounds landed in community	Number vessels delivering	Number of Processors		
2008	3.12	0.83	0.06	0.00	0.99	0.98	0.49	0.97	78%	0.91
2009	3.10	0.84	0.06	0.00	0.99	0.98	0.48	0.97	78%	0.90
2010	3.10	0.85	0.05	0.00	0.99	0.98	0.46	0.97	78%	0.90
2011	3.11	0.83	0.06	0.00	0.99	0.98	0.48	0.97	78%	0.90
2012	3.09	0.84	0.07	0.00	0.99	0.98	0.47	0.97	77%	0.90
2013	3.10	0.84	0.05	0.00	0.99	0.98	0.47	0.98	78%	0.90
2014	3.12	0.82	0.06	0.00	0.99	0.98	0.50	0.97	78%	0.91
2015	3.12	0.81	0.06	0.00	0.99	0.98	0.50	0.97	78%	0.91
2016	3.14	0.79	0.07	0.00	0.98	0.98	0.53	0.97	79%	0.91
2017	3.16	0.77	0.07	0.00	0.98	0.98	0.55	0.96	79%	0.91
2018	3.13	0.78	0.08	0.00	0.98	0.97	0.54	0.96	78%	0.91
2019	3.13	0.78	0.09	0.00	0.98	0.97	0.54	0.96	78%	0.91
2020	3.12	0.79	0.09	0.00	0.98	0.97	0.53	0.97	78%	0.91
2021	3.11	0.79	0.10	0.00	0.98	0.97	0.54	0.96	78%	0.90

Commercial Processing Engagement

Table 4. Index scores of communities highly engaged in commercial processing of groundfish 2008 – 2021.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Akutan	1.09	1.22	1.17	1.24	1.19	1.16	1.30	1.29	1.24	1.44	1.46	1.51	1.42	1.67
At-Sea Processor	9.32	9.25	9.35	9.20	9.22	9.30	9.07	9.17	9.18	9.22	9.14	9.17	9.18	9.02
Unalaska/Dutch Harbor	2.38	2.42	2.04	2.44	2.40	2.29	2.69	2.42	2.39	2.13	2.48	2.42	2.49	2.58
Kodiak	1.71	1.79	1.94	2.03	2.05	1.86	2.17	2.14	2.10	1.89	1.67	1.67	1.64	1.82

*Shaded cells are index scores above one (one standard deviation above the mean of zero) for at least one year (2008-2021).

Table 4 presents index scores for the four community groupings that were Highly Engaged (i.e., had an index score above one, which is one standard deviation above the mean of zero) for at least one year from 2008-2021, and these cells are shaded in Table 4. All four communities (Akutan, At-Sea Processors, Kodiak, and Unalaska/Dutch Harbor) were highly engaged in commercial processing for all 14 years from 2008-2021, as shown in Figure 7. The At-Sea Processor grouping has consistently held the highest engagement scores over time due to the large number of vessels and the allocations of BSAI FMP groundfish species to this sector relative to shore-based communities.

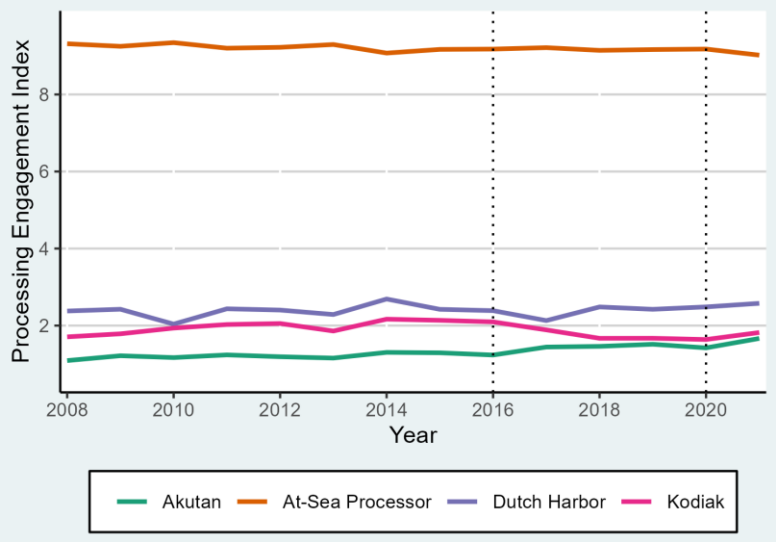
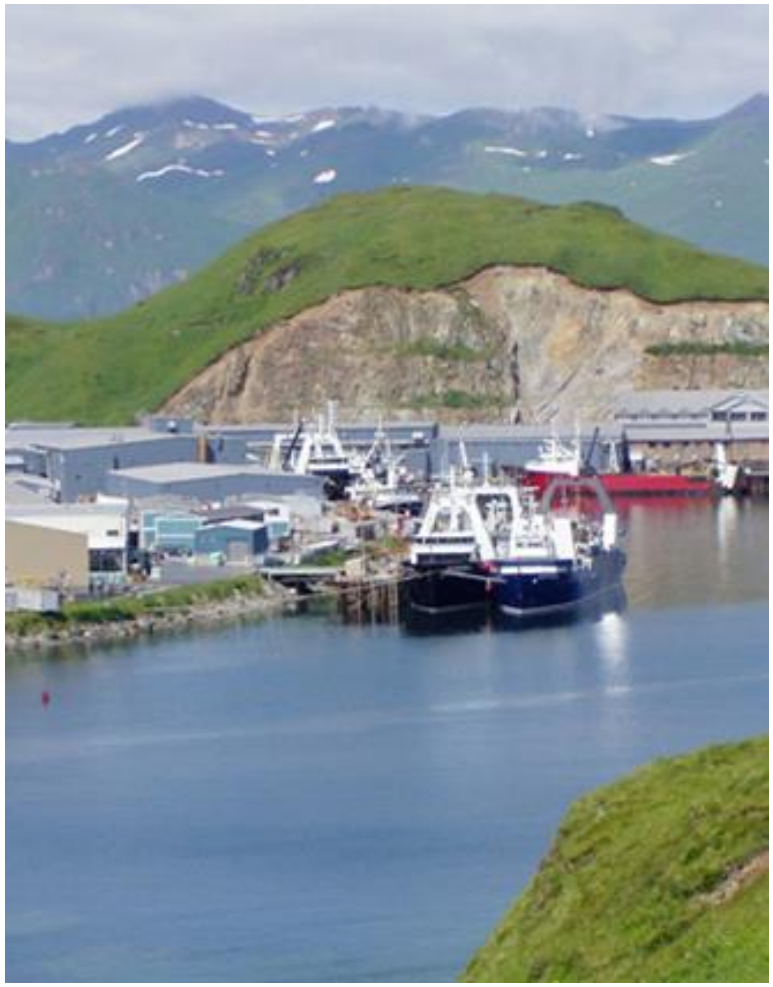


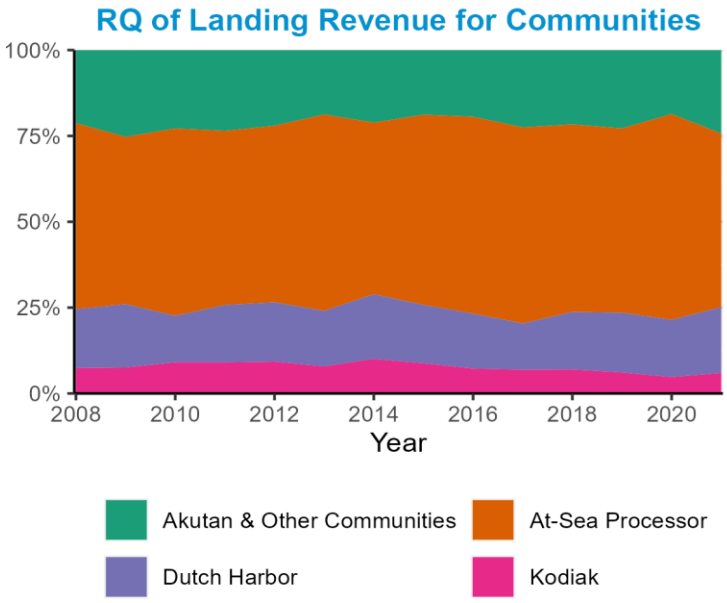
Figure 7. Index scores of communities highly engaged in commercial processing for at least 1 year from 2008-2021. Dotted lines indicate the previous 5 year period (2016-2020).

Unalaska/Dutch Harbor and Kodiak are the two shoreside communities with the highest processing engagement. Processing engagement in Kodiak declined from 2017 through 2020 with reductions in Pacific cod and sablefish landings and revenue before experiencing a slight increase in 2021. Unalaska/Dutch Harbor, Akutan, and to a lesser degree Kodiak, all experienced increases in their processing engagement scores in 2021 when compared with their mean value for the previous five years (2016-2020).



Processing Regional Quotient

Another measure of community participation in commercial FMP groundfish fisheries is its processing regional quotient (RQ), defined as the share of commercial revenues within a community out of the total North Pacific FMP groundfish revenues. The RQ is an indicator of the percentage contribution in that community, relative to the total revenues (including shorebased and at-sea) from all BSAI and Gulf FMP Groundfish landings. Figure 8 shows the processing RQ in terms of ex-vessel revenue from 2008-2021.



The most prominent community for processing FMP groundfish in terms of landing weight has been the At-Sea Processing grouping, which accounted for approximately 54% of FMP groundfish landing ex-vessel revenues over the period 2008-2021. In terms of shoreside processing, Dutch Harbor/Unalaska had the largest share of landings revenue, averaging 17% over the same period. The two other communities highly engaged in FMP groundfish processing are Kodiak and Akutan. Kodiak averaged nearly 8% of FMP groundfish landings revenues over this period while Akutan and all other communities averaged nearly 22%.

Comparing 2021 to the past five years, the share of landings revenue for the at-sea sector has fallen by nearly 11% to 50.5% in 2021. Kodiak also experienced a moderate decline of 6% in processing RQ to just below 6% in 2021. Unalaska/Dutch Harbor and Akutan and Other Communities both experienced double digit increased in their processing RQ in 2021 compared with the average 2016-2020 period. This resulted in an increase in the share of processing RQ in Unalaska/Dutch Harbor by 19% and 16% in Akutan and Other Communities, resulting in a processing RQ value in 2021 of 19% and 24%, respectively.

Figure 8. Processing regional quotient of landings revenue for communities highly engaged in commercial processing for all years from 2008-2021.

Participation Summary for FMP Groundfish fisheries

Based on the community engagement index scores for both commercial processing and commercial harvesting engagement, communities were categorized into low (index scores below the mean of 0), medium (index scores between 0 and 0.5), medium-high (index scores between 0.50001 and 1), and high engagement (index scores above 1) for each year. The number of years a community is in each category for the processing and harvesting engagement indices is presented in Table 5.

There are 29 communities or community groupings in Table 5 that had medium, medium-high, or high engagement in either harvesting or processing engagement, and nine communities were highly engaged in one aspect of commercial fisheries in any year from 2008-2021. There were four communities that were highly engaged in processing engagement and six that were highly engaged in harvesting engagement for at least one year from 2008-2021.

Table 5. Number of years by processing and harvesting engagement level for all commercial fisheries. Alaska communities not listed had low processing and harvesting engagement in all years (2008-2021). Shading indicates High engagement (blue).

Community	Harvesting Engagement				Processing Engagement			
	Low	Medium	Medium-High	High	Low	Medium	Medium-High	High
Adak	14	0	0	0	11	3	0	0
Akutan	14	0	0	0	0	0	0	14
All Other States	0	12	2	0	14	0	0	0
Anchorage	0	13	1	0	14	0	0	0
At-Sea Processor	14	0	0	0	0	0	0	14
Cordova	4	10	0	0	0	14	0	0
Craig	0	14	0	0	4	10	0	0
Dutch Harbor	14	0	0	0	0	0	0	14
Haines	11	3	0	0	14	0	0	0
Homer	0	0	0	14	0	0	14	0
Hoonah	14	0	0	0	9	5	0	0
Inshore Stationary Floating Processor	14	0	0	0	7	7	0	0
Juneau	0	0	14	0	0	14	0	0
Ketchikan	0	14	0	0	4	10	0	0
King Cove	13	1	0	0	0	14	0	0
Kodiak	0	0	0	14	0	0	0	14
Newport	0	14	0	0	14	0	0	0
Other Oregon	0	12	2	0	14	0	0	0
Other Washington	0	0	0	14	14	0	0	0
Petersburg	0	0	0	14	0	10	4	0
Saint Paul	13	1	0	0	14	0	0	0
Sand Point	0	14	0	0	0	14	0	0
Seattle MSA	0	0	0	14	14	0	0	0
Seward	12	2	0	0	0	6	8	0
Sitka	0	0	0	14	0	0	14	0
Wasilla	4	10	0	0	14	0	0	0
Whittier	14	0	0	0	12	2	0	0
Wrangell	7	7	0	0	10	4	0	0
Yakutat	14	0	0	0	0	14	0	0

Groundfish Fishery Taxes

Taxes generated by fisheries, are important revenue sources for communities, boroughs, and the State. There are two main sources of fishery taxes in Alaska: shared taxes administered through the State of Alaska, and municipal fisheries taxes independently established and collected at select municipalities.

STATE TAXES. The fisheries business tax, implemented in 1990, is levied on businesses that process or export fisheries resources from Alaska. Tax rates vary between 1%-35 under the fisheries business tax, depending on a variety of factors, including: level of establishment, and whether processing occurs shoreside or offshore. Although the fisheries business tax is typically administered and collected by individual boroughs, revenue from the tax is deposited in Alaska's General Fund; then the State legislature appropriates 25%-50% of the tax revenue back to the municipality or borough. This tax is levied on processed fishery This tax is levied on processed fishery resources—primarily from catcher-processors and at-sea processors that bring their products into Alaska for trans-shipment—whether they are destined for local national consumption or shipment abroad.

MUNICIPAL TAXES. Some communities also collect local taxes related to the fishing industry. These include taxes on raw fish transfers across public docks, fuel transfers, extraterritorial fish, and marine fuel sales, and fees for bulk fuel transfer, boat hauls, harbor usage, port and dock usage, and storing gear on public land. There is no one source for data on these revenue streams; however, most communities self-report in annual municipal budgets collected by the Alaska Division of Community and Regional Affairs. Notably, some communities report fish tax revenue as sales tax, which affects the accuracy of municipal tax data reported throughout this document.

Tax data can contribute to the understanding of fisheries benefits to communities, but should be considered carefully given the inconsistencies variations in reporting. Because the fisheries taxes are managed by various municipal bodies (e.g., the community, state, borough, harbor, or municipality) , there are variations in the timing and of recording of tax data, as well as which communities collect raw fish tax. These nuances render the data inadequate for time series or direct comparisons of communities or regions. Despite these challenges, these data can provide a general overview of some quantifiable fisheries benefit to communities. Figure descriptions include specific nuances within the dataset, but it should be noted that this analysis is a preliminary approach and work continues with communities to improve accuracy.

Figure 9 shows the eight communities that report the highest share of fishery tax revenue from 2012-2021. Unalaska reports the most fishery related tax revenue through the Fishery Business and Fishery Landing taxes and municipal raw fish tax. In 2017, Unalaska's reported fishery tax revenue fell by over $4 million, with a slight uptick in 2020. Akutan was entirely dependent on fishery tax revenue until 2017, when the community implemented a 1.5% sales tax, and ceased the municipal raw fish tax. No taxes were reported by Kodiak in 2021.

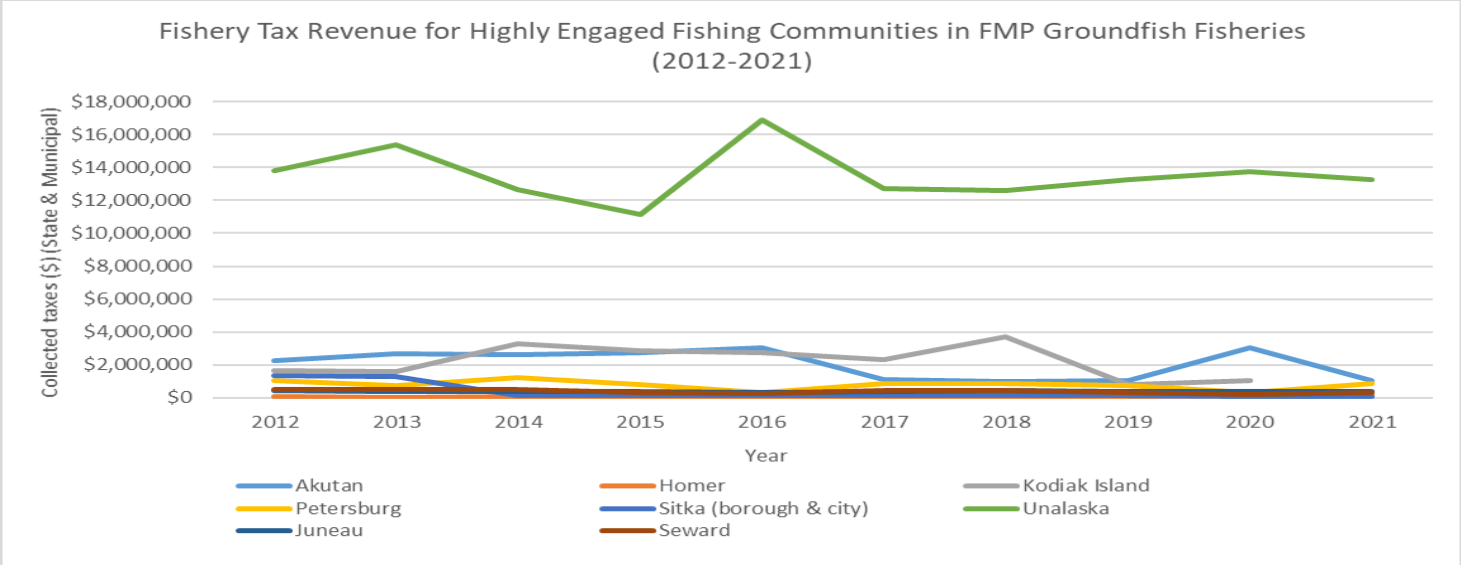


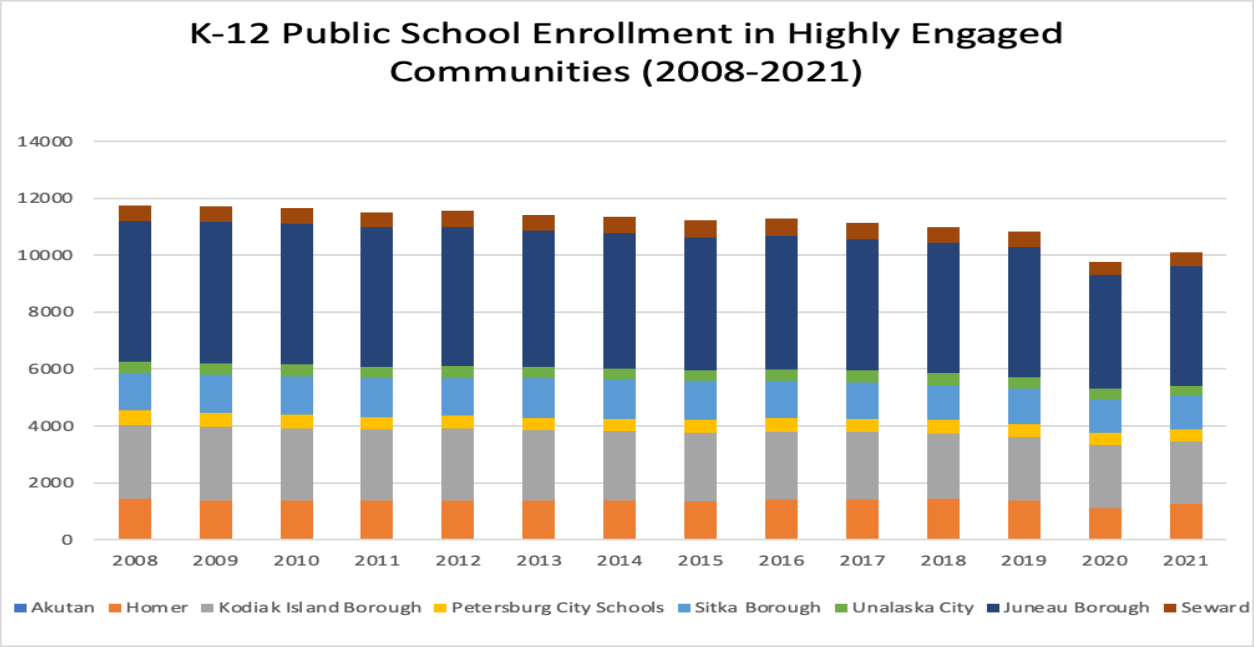
Figure 9. Fishery tax revenue for highly engaged fishir in FMP Groundfish Fisheries from 2012-2021. Includes only Alaskan communities; excludes data ass ıttle MSA, Washington, Oregon, and at-sea landings. Kodiak tax data were not reported in 2021. Kodiak, Sit urg include borough-level tax data.

School Enrollment in Groundfish Communities

School enrollment trends can provide information on community wellbeing. Public schools offer a space for people to gather and participate in community events and shared wellbeing, particularly in rural areas with limited infrastructure. Schools provide public resources such as libraries, internet access, and other facilities that benefit the greater community. Schools with declining enrollment may indicate population outmigration, a declining tax base, or shifts in employment opportunities. Figure 10 presents K-12 public school enrollment numbers for the eight highly engaged groundfish communities within Alaska (in both the harvesting and processing sector).

Overall, from 2008-2021, there has been a decline in enrollment of approximately 1,649 students (down 14%) for Homer, Kodiak, Petersburg, Sitka, Unalaska, Seward, and Juneau combined; however, Akutan school district experienced a 186% growth in enrollment. This is likely connected to a increase in fisheries processing employment. It should be noted that Akutan's growth rate reflects the community's very small enrollment size. Petersburg experienced the greatest enrollment decline (-18%), followed by Kodiak (-16%), Juneau (-15%), and Unalaska (-13%). These declines have been exacerbated by the COVID-19 Pandemic school closures.

Figure 10. Highly engaged FMP groundfish communities (either harvesting or processing) K-12 public school student enrollment from 2008-2021.



SECTION III: Community Participation in North Pacific Crab Fisheries

Map design: Brett Holycross, Pacific States Marine Fisheries Commission, 2023.

Collapse of the Bering Sea Crab Fisheries

Closures

- Bristol Bay Red King Crab
- Bering Sea Snow crab
- Bering Sea Tanner or bairdi crab in eastern Bering Sea
- Saint Matthew blue king crab
- Pribilof red and blue king crab

Reduced TAC

- Bering Sea Tanner or bairdi crab in western Bering Sea - reduced 53%

Alaska Commercial Crab Fisheries

Ten species of crabs are caught in Alaskan crab fisheries, and seven of these have commercial importance: red king crab, *Paralithodes camtschaticus*; blue king crab, *P. platypus*; golden king crab, *Lithodes aequispinus*; Tanner crab, *Chionoecetes bairdi*; snow crab, *C. opilio*; hair crab, *Erimacrus isenbeckii*; and Dungeness crab, *Cancer magister*. The three minor species, scarlet king crab, *L. couesi*; grooved Tanner crab, *C. tanneri*; and Triangle Tanner crab, *C. angulatus*, are landed mostly as incidental catch in other crab fisheries. In addition to commercial fisheries, subsistence and personal use fisheries support local food security and cultural cohesion.

The Bering Sea/Aleutian Islands (BSAI) king and Tanner crab fisheries are co-managed by the State of Alaska, NMFS, and NPFMC. In 2021, the FMP BSAI crab fisheries an active fleet of 67 catcher vessels and two catcher processors, and landed and processed at 15 processing facilities throughout the region.[4] Commercial crab fisheries blossomed in the 1950s with the market of king crab fisheries in the Bering Sea, but today many of the stocks are in a depressed state. The declines in Bering Sea crab fisheries and the subsequent closures drastically affected fishermen as well as the social, cultural, and economic wellbeing of fishing communities, including economic dependence, social networks, food security, and identity.[2]

In 2021 and 2022, several crab stocks experienced unprecedented declines, resulting in closures and drops in total allowable catch (TAC) for a suite of crab fisheries. In 2020, ADFG announced a closure of the summer commercial Norton Sound Red King Crab (NSRKC) fishery due to historical record declines. To support rebuilding efforts, The Norton Sound Economic Development Corporation ceased buying NSRKC through 2023.

Evidence indicates that snow crab and red king crab declines are related to climate change. The crash of the Bering Sea snow crab stock was affected by the 2019 heat wave in the North Pacific. Marine heat waves have been attributed to climate change.[1] Ongoing research into the social and economic effects of declining fisheries can inform adaptation strategies for future climate risks and decision-making and climate-ready fisheries.[3]

In January 2023, The Department of Commerce announced **federal fishery disasters for the following harvests:**

- 2021/2022 Alaska Bristol Bay Red King Crab and Bering Sea Snow Crab Fisheries
- 2020/2021 Alaska Norton Sound Red King Crab Fisheries
- 2022/2023 Alaska Bristol Bay Red King Crab and Bering Sea Snow Crab Fisheries

Cancellations of the 2022/2023 Bering Sea snow crab, the 2022/2023 Bristol Bay red king crab, and the 2021/2022 Bristol Bay red king crab harvests have caused an estimated $287.7 million in economic losses for fisheries.

Commercial Crab Harvesting Engagement

Performance metrics of community participation in Alaska crab FMP fisheries from calendar years 2000-2021 were created with data collected from 40 communities or community groupings throughout the U.S. that had either some commercial FMP crab fisheries landings or residents who owned vessels used in commercial FMP crab fishing during this time period. Of these 40 communities, only 14 had any FMP crab landings in their community while 36 had a resident who owned a vessel that participated in FMP crab fisheries. All 40 communities were included in both the crab harvesting and processing engagement indices.

Figure 11 shows the aggregate annual values of the four variables that make up the harvesting engagement index for each year to better understand the absolute changes in North Pacific crab harvesting activities that are underlying the relative harvesting engagement index. Aggregate revenues in calendar year 2021 (which mostly represent the 2020/2021 Bering Sea Snow crab fishery because the 2021/2022 Bristol Bay Red King Crab fishery was closed) were still up 54% compared with the 2016-2020 average.

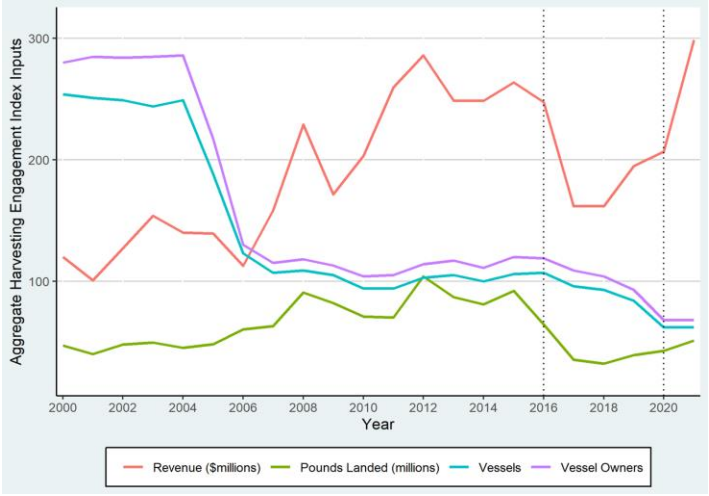


Figure 11. Aggregate annual Crab Harvesting Engagement Index inputs. Dotted lines indicate the previous 5 year period (2016-2020).

Table 6. Commercial harvesting engagement PCFA results (2000 – 2021)

YEAR	Eigenvalues				Factor Loadings				Percent varience explained	Armor's Theta
	1	2	3	4	Ex-vessel value from vessel owners	Pounds Landed by vessel owners	Total # fishing vessels	Total #of unique vessel owners		
2000	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	99.8%	1.00
2001	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	99.7%	1.00
2002	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	99.7%	1.00
2003	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	99.9%	1.00
2004	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	99.8%	1.00
2005	3.98	0.02	0.00	0.00	1.00	1.00	1.00	1.00	99.5%	1.00
2006	3.93	0.07	0.00	0.00	0.99	0.99	0.99	0.99	98.2%	0.99
2007	3.90	0.10	0.00	0.00	0.99	0.99	0.99	0.99	97.6%	0.99
2008	3.94	0.06	0.00	0.00	0.99	0.99	0.99	0.99	98.5%	1.00
2009	3.93	0.07	0.00	0.00	0.99	0.99	0.99	0.99	98.3%	0.99
2010	3.91	0.09	0.00	0.00	0.99	0.99	0.99	0.99	97.8%	0.99
2011	3.90	0.10	0.00	0.00	0.99	0.99	0.99	0.98	97.4%	0.99
2012	3.88	0.12	0.00	0.00	0.98	0.99	0.99	0.98	96.9%	0.99
2013	3.85	0.14	0.00	0.00	0.98	0.98	0.98	0.98	96.4%	0.99
2014	3.83	0.17	0.00	0.00	0.98	0.98	0.98	0.98	95.7%	0.99
2015	3.85	0.15	0.00	0.00	0.98	0.98	0.98	0.98	96.2%	0.99
2016	3.83	0.17	0.00	0.00	0.98	0.98	0.98	0.98	95.8%	0.99
2017	3.81	0.19	0.00	0.00	0.98	0.98	0.98	0.97	95.2%	0.98
2018	3.84	0.15	0.00	0.00	0.98	0.98	0.98	0.98	96.1%	0.99
2019	3.86	0.14	0.00	0.00	0.98	0.98	0.98	0.98	96.5%	0.99
2020	3.97	0.02	0.00	0.00	1.00	1.00	1.00	1.00	99.4%	1.00
2021	3.98	0.02	0.00	0.00	1.00	1.00	1.00	1.00	99.5%	1.00

Commercial Harvesting Engagement

Table 7. Index scores of communities highly engaged in commercial harvest of Crab for at least 1 year 2000 – 2019.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Anchorage	-0.03	0.03	0.04	0.03	0.04	0.13	0.17	0.78	0.86	0.64	0.97	0.85	0.96	1.17	1.21	1.24	0.69	0.62	0.68	0.63	0.63	0.92
Kodiak	1.40	1.30	1.15	0.94	1.01	0.86	0.94	0.94	1.12	1.09	0.81	0.81	0.87	0.80	0.77	0.72	0.66	0.65	0.54	0.57	0.69	0.66
Seattle MSA	5.89	5.92	5.95	5.98	5.96	6.01	5.97	5.88	5.86	5.90	5.86	5.87	5.83	5.76	5.74	5.76	5.87	5.86	5.91	5.93	6.00	5.95

*Shaded cells are index scores above one (which is one standard deviation above the mean of zero) for at least one year from 2000-2019.

In 2021, landings were also up 19% from the 2016-2020 average. The number of vessels decreased that same year, down 30% in vessels, and with 31% fewer vessel owners compared with the average of the 2016-2020 period.

The results of the commercial harvesting engagement PCFA analyses are shown in Table 6 which presents the eigenvalues, factor loadings, total variance explained, and Armor's theta reliability coefficient for all variables. The results suggest very strong relationships among variables, and that a single index based on the first extracted factor explains over 94% of the variation in each of the variables in each year. In addition to the goodness of fit statistics of the analyses provided in Table 6, each PCFA provides an index score for each of 36 communities included in the analysis. Table 7 presents these index scores for the three communities identified as highly engaged in FMP crab harvesting for at least one year between 2000 and 2021.

The harvesting engagement index is a relative indicator of community participation compared to the participation of all other communities that harvest FMP crab in Alaska. It is a measure of the presence of commercial crab fishing through residents who own commercial fishing vessels: this includes pounds landed by vessel, revenue, the number of vessel owners, and the total number of owners in a community.

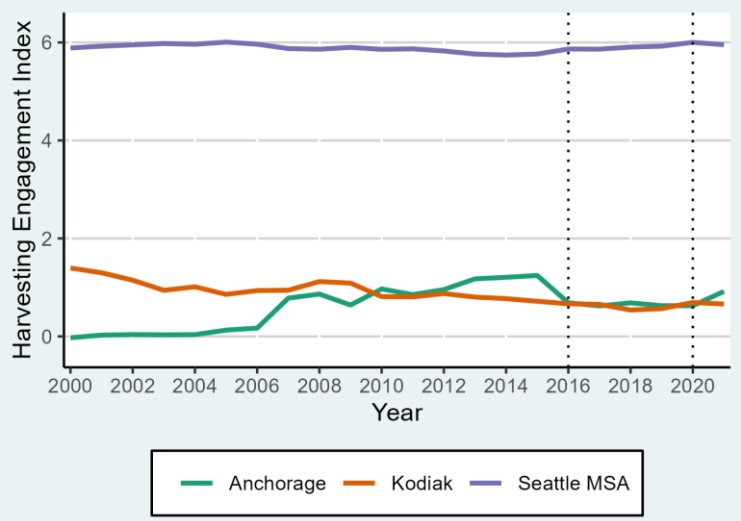


Figure 12. Index scores of communities highly engaged in commercial crab harvesting for at least 1 year from 2000-2021. Dotted lines indicate the previous 5 year period (2016-2020).

Table 7 presents the index scores for the communities that emerged as Highly Engaged in harvesting FMP crab (index score above one, which is one standard deviation above the mean of zero) for at least one year (2000-2021). Of the three groupings listed in Table 7, Seattle MSA is the only community grouping emerging as Highly Engaged in commercial crab harvesting for all years (see Figure 12).

Seattle MSA, which consists of Seattle and surrounding satellites and suburbs, has the highest degree of engagement over time, with consistent index scores well above 5.0 in all years from 2000-2021. Historically, Kodiak had high engagement scores, but since 2010 has had engagement scores below the threshold of 1.0. The relative decrease in engagement indices suggests fluctuations in U.S. crab fisheries participation. Anchorage's index scores rose from 2000 onward, peaking in 2015 above 1.0. Since 2016, however, Anchorage's engagement score has remained below the threshold of 1.0.

Harvesting Regional Quotient

The Regional Quotient (RQ) of commercial crab harvesting was calculated using vessel owner residency for those vessels participating in North Pacific FMP crab fisheries to better understand where revenues from crab harvesting enters local economies. This metric is based on residency of vessel owners with vessels that are active in the fisheries. It is assumed that some portion of revenue gained from participation in the FMP crab fisheries is spent and circulated in the local economy through direct and indirect purchases of goods and services. The harvesting RQ is an indicator of the percentage of revenue from FMP crab from resident vessel owners in a community relative the total (shore-based and at-sea) revenue across all BSAI King and Tanner Crab FMP fisheries.

Figure 13 shows the harvesting RQ for North Pacific FMP crab revenue from 2000-2021. The Seattle MSA has had the largest share of crab harvesting vessel owners, averaging 59% over the 2000-2021 period, followed by Other Communities at 21%, and Anchorage and Kodiak both at 10%. However, Kodiak's share has fallen over time from a high of 15% in 2000 to 6% in 2021, while Anchorage's share has increased from 2% in 2000 to a peak of 16% in 2015 to 13% in 2021.

Crew on crab fishing vessels also constitute an important component of crab fishery participants. The distribution

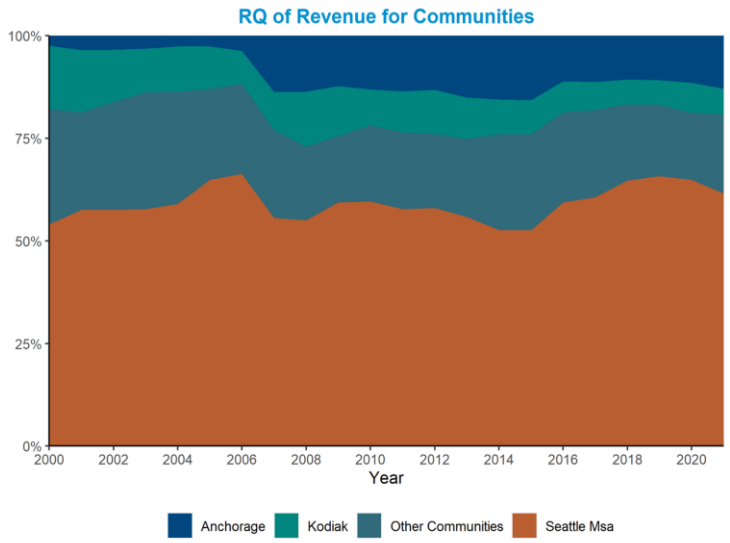


Figure 13. Harvesting regional quotient of revenue for communities highly engaged in commercial harvesting for any year from 2000-2021.

of the primary residence of crew participating in Crab Rationalization Program fisheries across highly engaged communities is shown in Figure 14. The share of crew from highly engaged communities averaged nearly 50% over the entire post-Crab Rationalization Period, 2006-2021, but their share has fallen from a high of 55% in 2007 to 46% in 2021, with a notable low of 29% in 2020. It is likely the travel restrictions implemented during the Covid-19 pandemic accounted for most of the difference. Crew from Alaska communities increased slightly (from 8% to 25%, and then back down to 9%.

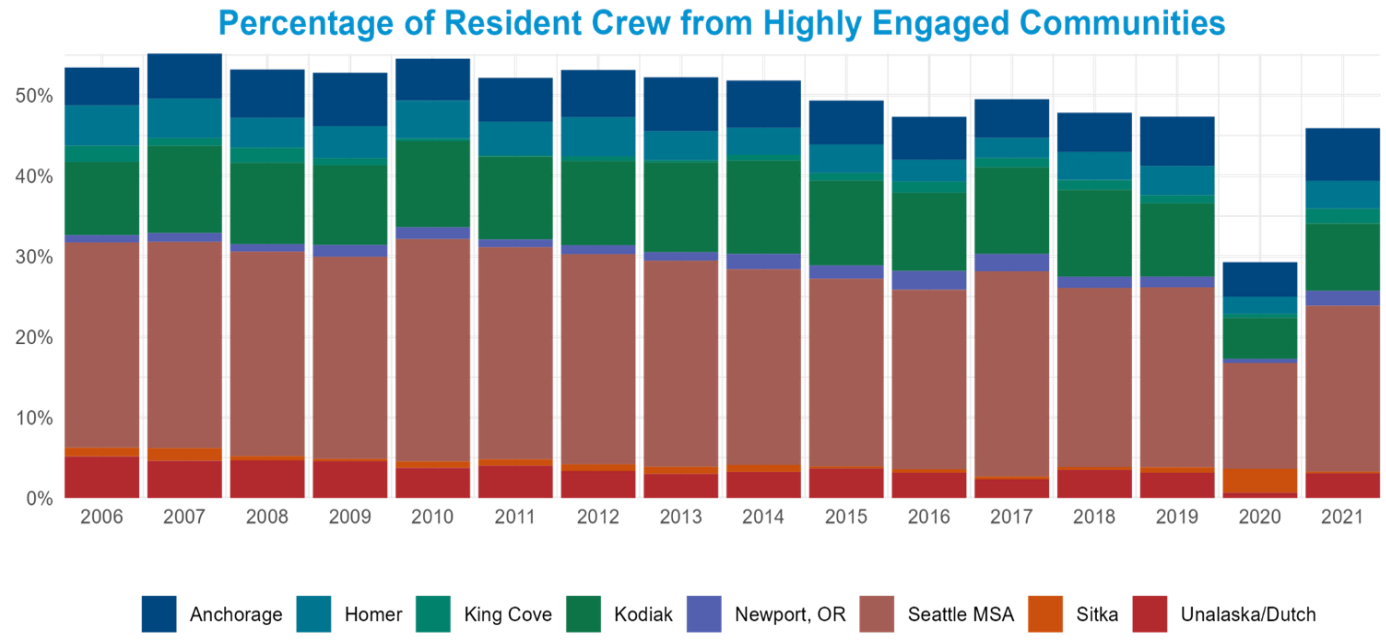


Figure 14. The percentage of crew by residence for top communities participating in crab harvest from rationalized crab fisheries in the BSAI. 2006-2021

Commercial Processing Engagement

The results of the commercial processing engagement PCFA analyses are shown in Table 8, which presents the eigenvalues, factor loadings, total variance explained, and Armor's theta reliability coefficient (Armor, 1974) for all of the variables included in each PCFA. The results suggest very strong relationships among variables and that a single index based on the first extracted factor explains over 82% of the variation in each of the variables in each year. In addition to the goodness of fit statistics of the analyses provided in Table 8, each PCFA provides an index score for each of the communities included in the analyses.

These index scores are presented in Table 9 (following page) for the six communities or groupings that were highly engaged (index score above one, which is one standard deviation above the mean of zero) for at least one year from 2000-2021. Cells indicating high engagement are shaded in Table 9. The index is a relative indicator of community participation compared to the participation of all other communities that process North Pacific FMP crab.

Tanner Crab
Chionoecetes bairdi and C. opilio

Table 8 - Commercial crab processing engagement PCFA results

YEAR	Eigenvalues				Factor Loadings				Percent variance explained	Armor's Theta
	1	2	3	4	Ex-vessel value	Pounds landed in community	Number vessels delivering	Number of Processors		
2000	3.47	0.50	0.02	0.01	0.98	0.97	0.99	0.76	87%	0.95
2001	3.28	0.66	0.04	0.02	0.97	0.96	0.99	0.66	82%	0.93
2002	3.39	0.55	0.03	0.02	0.97	0.95	0.99	0.76	85%	0.94
2003	3.51	0.46	0.02	0.01	0.98	0.97	0.99	0.80	88%	0.95
2004	3.58	0.39	0.03	0.01	0.98	0.97	0.99	0.84	90%	0.96
2005	3.53	0.42	0.05	0.01	0.98	0.96	0.98	0.82	88%	0.96
2006	3.67	0.20	0.11	0.02	0.98	0.97	0.96	0.92	92%	0.97
2007	3.55	0.41	0.03	0.01	0.97	0.94	0.98	0.87	89%	0.96
2008	3.56	0.36	0.07	0.01	0.98	0.95	0.98	0.86	89%	0.96
2009	3.72	0.21	0.06	0.02	0.98	0.97	0.98	0.93	93%	0.97
2010	3.58	0.35	0.06	0.02	0.97	0.94	0.98	0.89	89%	0.96
2011	3.74	0.17	0.08	0.01	0.98	0.97	0.97	0.95	94%	0.98
2012	3.74	0.22	0.03	0.01	0.98	0.97	0.99	0.93	93%	0.98
2013	3.61	0.34	0.04	0.01	0.96	0.97	0.98	0.89	90%	0.96
2014	3.55	0.39	0.05	0.01	0.96	0.95	0.97	0.88	89%	0.96
2015	3.67	0.31	0.02	0.01	0.97	0.95	0.98	0.93	92%	0.97
2016	3.77	0.18	0.04	0.01	0.98	0.97	0.96	0.97	94%	0.98
2017	3.60	0.29	0.09	0.02	0.97	0.94	0.94	0.94	90%	0.96
2018	3.56	0.36	0.07	0.01	0.96	0.94	0.95	0.92	89%	0.96
2019	3.75	0.17	0.07	0.01	0.98	0.97	0.96	0.96	94%	0.98
2020	3.77	0.16	0.06	0.01	0.99	0.99	0.96	0.94	94%	0.98
2021	3.84	0.12	0.04	0.01	0.98	0.99	0.98	0.96	96%	0.99

Commercial Processing Engagement

Table 9. Index scores of communities highly engaged in processing of Crab 2008 – 2021.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Akutan	0.79	0.53	0.54	0.57	0.71	0.62	1.08	1.11	1.36	0.86	1.11	1.66	1.96	1.71	1.90	2.51	2.13	2.06	2.06	1.93	1.89	0.83
At-Sea Processor	3.70	3.26	3.24	3.15	3.51	2.77	2.55	3.11	0.98	2.41	2.59	2.16	1.81	1.24	1.10	1.12	0.13	0.08	0.06	0.14	0.42	0.18
Unalaska/Dutch Harbor	4.28	4.56	4.52	4.72	4.51	4.92	4.77	4.75	4.54	4.21	4.17	4.01	3.88	4.02	4.13	4.13	4.38	4.51	4.40	4.25	4.47	4.40
King Cove	0.60	0.45	0.59	0.74	0.67	1.03	1.11	0.60	0.82	0.79	0.91	0.65	0.62	0.69	0.72	0.85	1.07	0.79	0.73	0.70	0.65	0.97
Nome	0.61	0.89	0.86	0.81	0.44	0.57	0.53	0.95	0.64	0.66	0.90	0.78	0.85	1.17	1.35	1.10	0.79	1.16	1.45	0.64	-0.21	0.08
Saint Paul	0.82	1.27	1.39	0.98	0.93	1.15	1.53	0.04	3.14	3.01	2.60	3.09	3.29	3.40	3.17	2.78	3.04	2.81	2.90	3.47	3.33	3.85

*Shaded cells are index scores above one (which is one standard deviation above the mean of zero) for at least one year from 2008-2021.

To better understand the absolute changes in North Pacific FMP crab processing over time, Figure 15 displays the aggregate annual values of the four variables that make up the processing engagement index for each year. Aggregate revenues and pounds landed were both down 17% and 9%, respectively, in 2021 compared with their 2016-2020 average. Of the six communities found in Table 9, only Unalaska/Dutch Harbor was highly engaged in commercial crab processing for all years from 2000-2021. Other communities were highly engaged for some portion of the time period, including Akutan, At-Sea Processors, and Saint Paul.

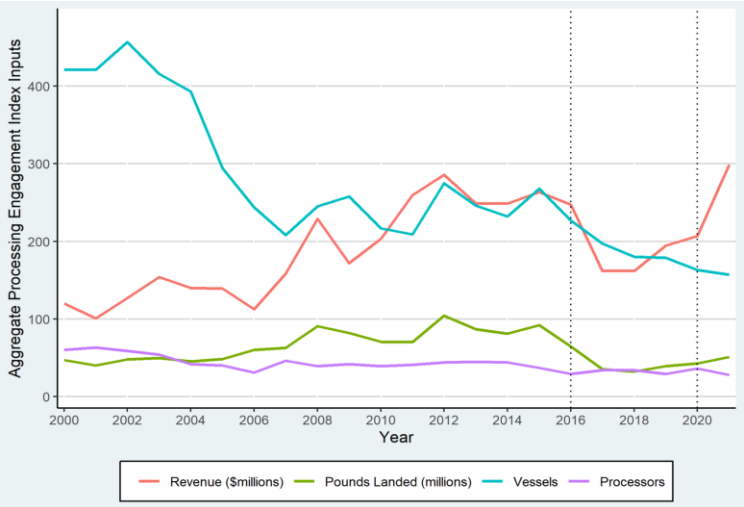


Figure 15. Aggregate annual Crab Processing Engagement Index inputs. Dotted lines indicate the previous 5 year period (2016-2020).

The At Sea processing sector scored as highly engaged fairly consistently until 2015; however, this analysis focuses on the sustained participation of place-based communities. Consistently Unalaska/Dutch Harbor has held the highest engagement scores over time, followed by Saint Paul. Processing engagement indices in Akutan increased, reaching a peak in 2015.

Although well below the threshold of 1.0 from 2000 - 2012, Nome's relative engagement indices have steadily increased over time with a dip in 2016, and declines starting again in 2019. Index scores of communities highly engaged for at least one year from 2000-2021 are shown in Figure 16.

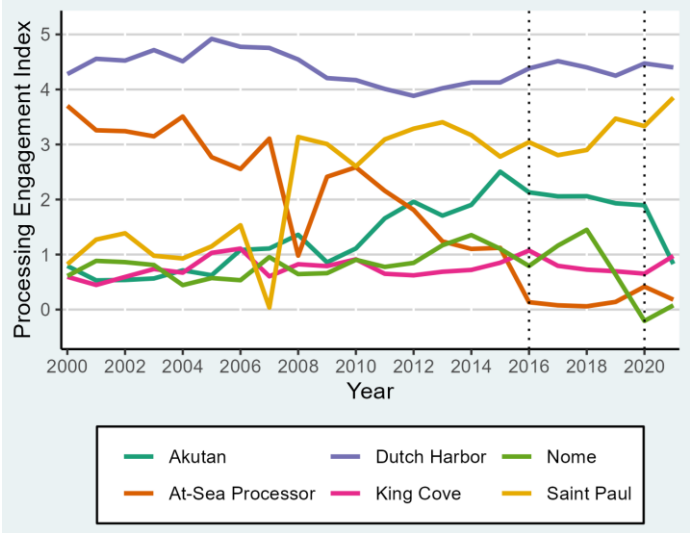
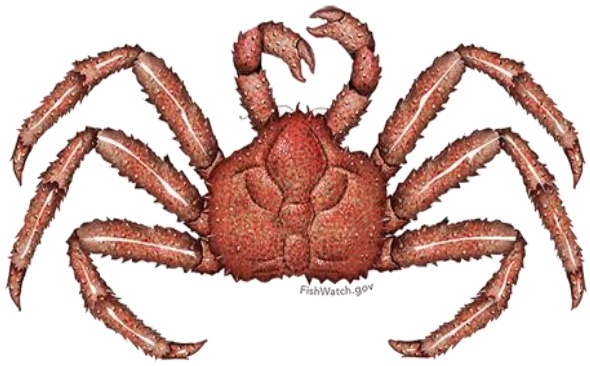


Figure 16. Index scores of communities highly engaged in commercial crab processing for at least one year from 2000-2021. Dotted lines indicate the previous 5 year period (2016-2020).



Alaska Red King Crab
Paralithodes camtschaticus

Processing Regional Quotient

The crab processing regional quotient (RQ) is defined as the share of commercial revenues within a community out of the total BSAI FMP crab revenues. The RQ is an indicator of the percentage contribution in that community relative to the total revenues (including shore-based and at-sea) from all communities. Figure 17 shows the FMP crab processing RQ for revenue from 2000-2021.

The most prominent community for processing FMP crab in terms of landing weight and revenue has been Unalaska/Dutch Harbor, which was also the only community highly engaged in FMP crab for all years in the analysis. In 2021, Unalaska/Dutch Harbor accounted for about 46% of FMP crab ex-vessel revenue, followed by St. Paul at 37%, and King Cove, Akutan, and other communities combined to nearly 13%. This represents a 72% increase in processing engagement for St. Paul compared to the 2016-2020 average, and a 65% decline for aggregated communities Akutan, King Cove, and other communities over the same period. The RQ range for Unalaska/Dutch Harbor varied from a peak of 53% in 2007 to a low of 36% in 2012, but consistently has been responsible for over 40% of delivered ex-vessel revenue from BSAI FMP crab species since 2014.

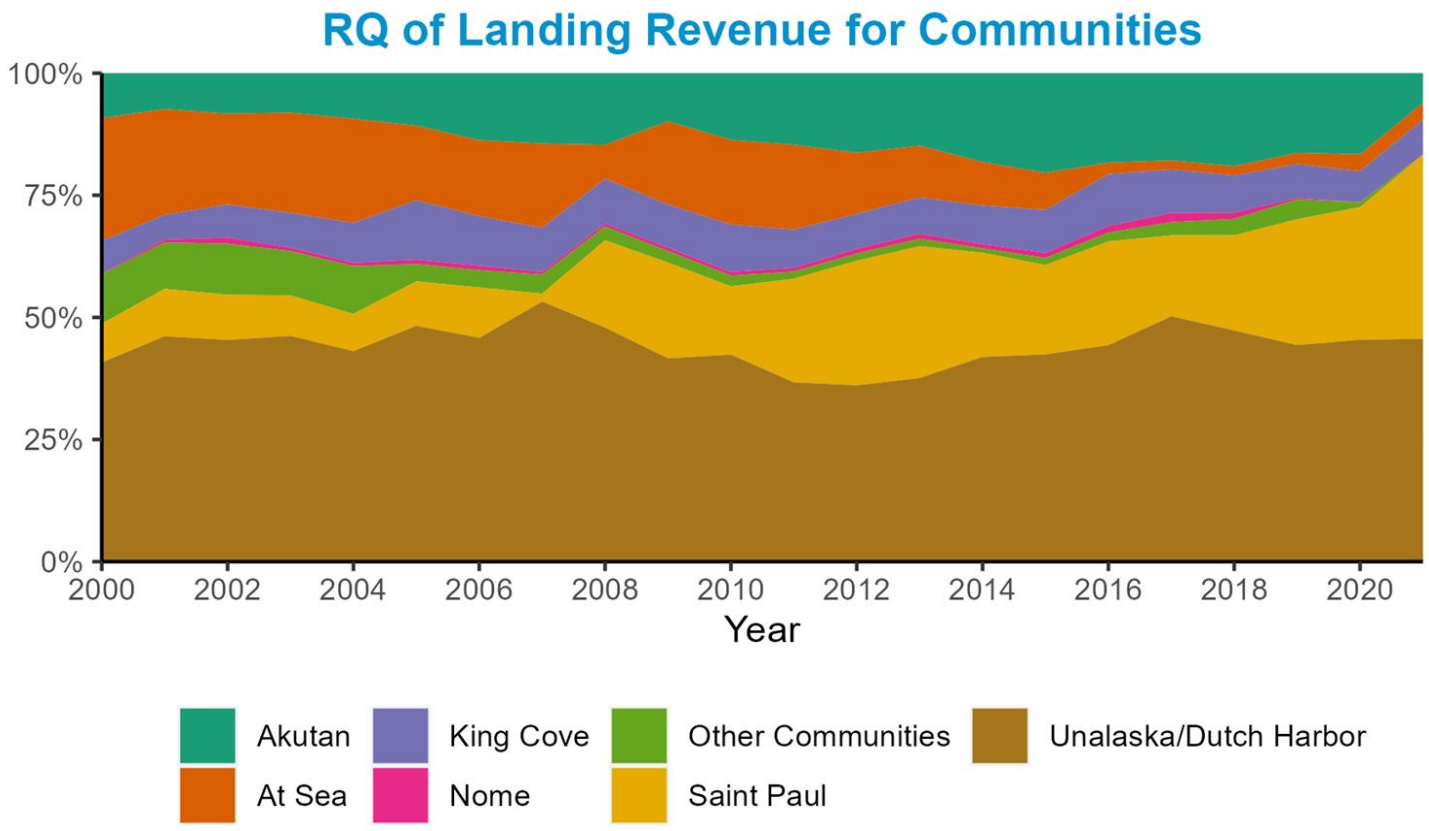


Figure 17. Processing regional quotient of landing revenue for communities highly engaged in commercial crab processing for one year from 2000-2021

Crab Fishery Taxes

Taxes generated by fisheries, are important revenue sources for communities, boroughs, and the State. There are two main sources of fishery taxes in Alaska: shared taxes administered through the State of Alaska, and municipal fisheries taxes independently established and collected at select municipalities.

STATE TAXES. The fisheries business tax, implemented in 1990, is levied on businesses that process or export fisheries resources from Alaska. Tax rates vary between 1%-35 under the fisheries business tax, depending on a variety of factors, including: level of establishment, and whether processing occurs shoreside or offshore. Although the fisheries business tax is typically administered and collected by individual boroughs, revenue from the tax is deposited in Alaska's General Fund; then the State legislature appropriates 25%-50% of the tax revenue back to the municipality or borough. This tax is levied on processed fishery This tax is levied on processed fishery resources—primarily from catcher-processors and at-sea processors that bring their products into Alaska for trans-shipment—whether they are destined for local national consumption or shipment abroad.

MUNICIPAL TAXES. Some communities also collect local taxes related to the fishing industry. These include taxes on raw fish transfers across public docks, fuel transfers, extraterritorial fish, and marine fuel sales, and fees for bulk fuel transfer, boat haulouts, harbor usage, port and dock usage, and storing gear on public land. There is no one source for data on these revenue streams; however, most communities self-report in annual municipal budgets collected by the Alaska Division of Community and Regional Affairs. Notably, some communities report fish tax revenue as sales tax, which affects the accuracy of municipal tax data reported throughout this document. Tax data can contribute to the understanding of fisheries benefits to communities, but should be considered carefully given the inconsistencies variations in reporting. Because the fisheries taxes are managed by various municipal bodies (e.g., the community, state, borough, harbor, or municipality) , there are variations in the timing and of recording of tax data, as well as which communities collect raw fish tax. These nuances render the data inadequate for time series or direct comparisons of communities or regions. Despite these challenges, these data can provide a general overview of some quantifiable fisheries benefit to communities. Figure descriptions include specific nuances within the dataset, but it should be noted that this analysis is a preliminary approach and work continues with communities to improve accuracy.

Figure 18 shows the top seven communities that report the highest share of fishery tax revenue from 2012-2021. Unalaska reports the most fishery related tax revenue through the Fishery Business and Fishery Landing taxes and municipal raw fish tax. In 2017, Unalaska's reported fishery tax revenue fell by over $4 million, with a slight uptick in 2020. Akutan was entirely dependent on fishery tax revenue until 2017, when the community implemented a 1.5% sales tax, and ceased the municipal raw fish tax. Saint Paul did not report a raw fish tax in 2013 or 2015.

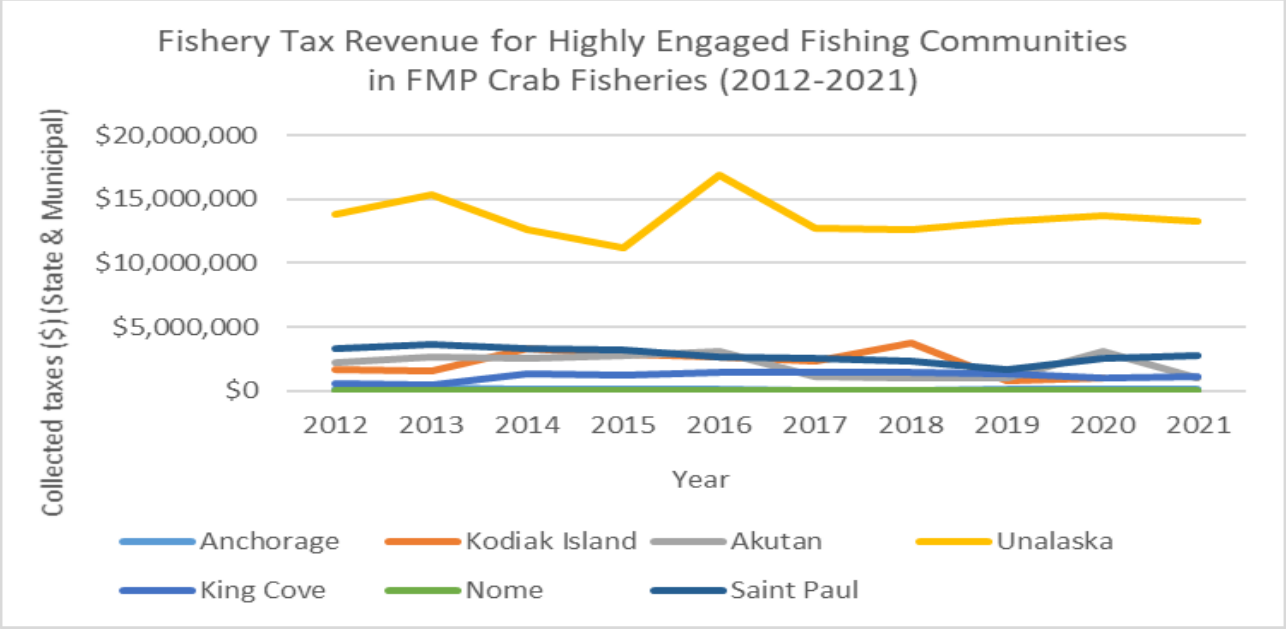


Figure 18. Fishery tax revenue for highly engaged fishing communities in FMP Crab Fisheries from 2012-2021. This figure only includes Alaskan communities and excludes data associated with at-sea landings.

School Enrollment in Crab Communities

School enrollment trends can provide information on community wellbeing. Public schools offer a space for people to gather and participate in community events and shared wellbeing, particularly in rural areas with limited infrastructure. Schools provide public resources such as libraries, internet access, and other facilities that benefit the greater community. Schools with declining enrollment may indicate population outmigration, a declining tax base, or shifts in employment opportunities.

Figure 19 presents annual K-12 school enrollment from 2008-2021 for six of the seven communities highly engaged in FMP crab fisheries in the North Pacific (including those in harvesting and/or processing). School enrollment for Anchorage is presented separately in Figure 20, given the difference in scale between Anchorage and the other six communities. Overall, from 2008-2021, there has been a decrease of 530 students between 2008-2021, or about 14% of total enrollment for these highly engaged fishing communities in the region. Communities with declining student enrollment between 2008 and 2021 include: Saint Paul (-56%), Kodiak (-16%), and King Cove (-33%), and Unalaska (-13%). Saint George Island school closed in 2018, leaving Saint Paul's school the only remaining in the Pribilof Islands.

Some communities showed increased school enrollment between 2008 and 2021. Akutan's student enrollment went up by 186%, and Nome's enrollment went up by about 1%. It should be noted, however, that Akutan has very low student enrollment numbers (between 7-20 students), and so an increase in only a few students will drastically increase growth percentages. Anchorage schools have also experienced a decrease in student enrollment, with an 12% drop between 2008 and 2021. There was a 9% drop in student enrollment between 2019 and 2020 alone, likely related to the the COVID-19 pandemic school closures.

In general, there have been important declines in school enrollment for most of the communities rated as highly engaged in Alaska FEP crab fisheries. Additional research is needed to better understanding the causes of these declines, as well as the enduring effects of the COVID pandemic on school enrollment.

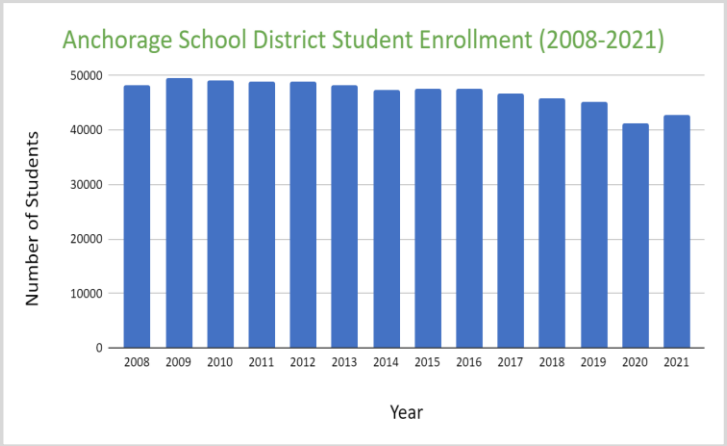


Figure 20. Anchorage school district enrollment numbers from 2008-2021.

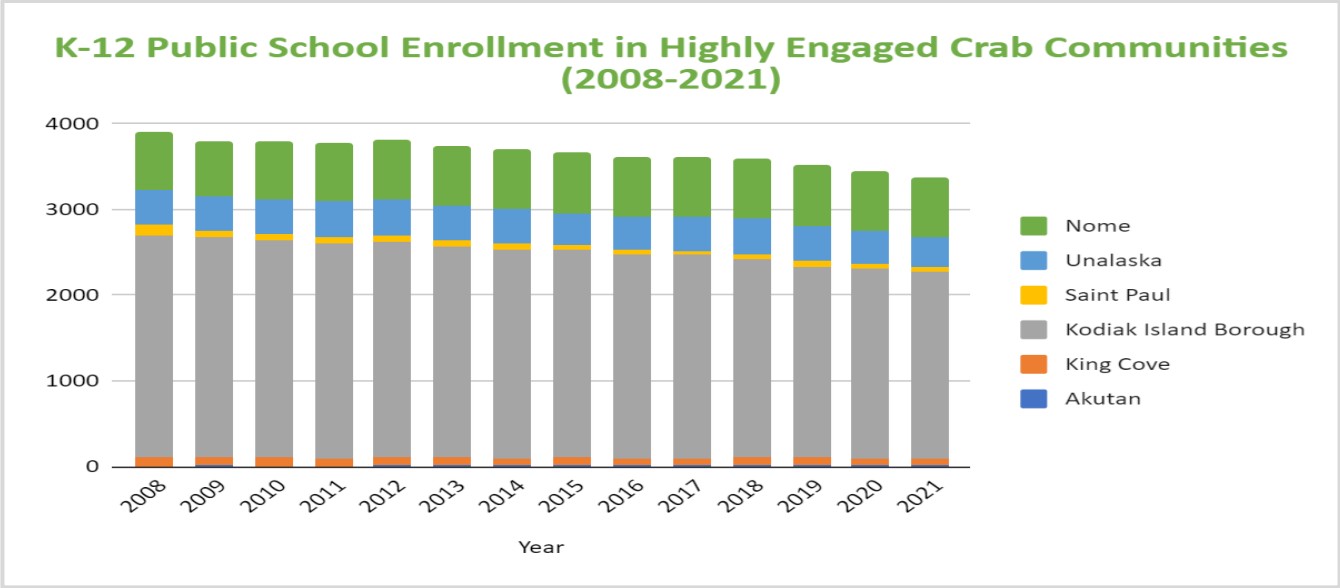


Figure 19. K-12 public school student enrollment for highly engaged crab communities combined (either harvesting or processing) from 2008-2021 excluding Anchorage.

Participation Summary for FMP crab fisheries

Based on the community engagement index scores for both commercial processing and harvesting engagement in the North Pacific crab FMP fisheries, communities were categorized into low (index scores below the mean of 0), medium (index scores between 0 and 0.5), medium-high (index scores between 0.50001 and 1), and high engagement (index scores above 1) for each year. The number of years a community is in each category for the processing and harvesting engagement indices is presented in Table 10. There are 20 communities or community groupings in Table 10 that had medium, medium-high, or high engagement in either harvesting or processing engagement and nine communities were highly engaged in one aspect of FMP crab fisheries in any year from 2008-2021. There were three communities that were highly engaged in processing engagement and six that were highly engaged in harvesting engagement for at least one year from 2008-2021.

Table 10. Number of years by processing and harvesting engagement level for all commercial FMP crab fisheries. Alaska communities not listed had low FMP crab processing and harvesting engagement in all years (2008-2019). Shading indicates High engagement (green).

Community	Harvesting Engagement				Processing Engagement			
	Low	Medium	Medium-High	High	Low	Medium	Medium-High	High
Adak	22	0	0	0	12	10	0	0
Akutan	22	0	0	0	0	0	8	14
All Other States	21	1	0	0	22	0	0	0
Anchorage	1	6	12	3	22	0	0	0
At-Sea Processor	22	0	0	0	0	6	1	15
Unalaska/Dutch Harbor	22	0	0	0	0	0	0	22
Golovin	21	1	0	0	22	0	0	0
Homer	5	17	0	0	22	0	0	0
Hood River	13	9	0	0	22	0	0	0
King Cove	22	0	0	0	0	1	18	3
Kodiak	0	0	16	6	3	16	3	0
Lincoln	0	22	0	0	22	0	0	0
Nome	7	5	10	0	1	2	14	5
Other Oregon	2	20	0	0	22	0	0	0
Other Washington	1	21	0	0	22	0	0	0
Saint Paul	22	0	0	0	0	1	3	18
Seattle MSA	0	0	0	22	22	0	0	0
Shaktoolik	15	7	0	0	22	0	0	0
Unalakleet	12	10	0	0	20	2	0	0
Wasilla	21	1	0	0	22	0	0	0

Community Sketches for FMP Crab and Groundfish Fisheries

Twelve communities were identified as being Highly Engaged in the North Pacific FMP groundfish and crab fisheries (in the harvesting or processing sector, or both) for at least one year from 2008-2021: Akutan, King Cove, Sand Point, Homer, Kodiak Island, Nome, Petersburg, the Seattle MSA, Sitka, Seward, St. Paul, and Unalaska. In the following section, detailed sketches provide an overview of how these communities differ geographically, historically, culturally, economically, and demographically. The purpose of the Community Sketches is to: 1) present a detailed snapshot of the communities with sustained and substantial engagement in Alaska FMP crab and groundfish fisheries; and 2) show linkages among social, economic, and policy processes to inform management decisions. By identifying key social and economic trends, these sketches can inform decision-making in Federally managed fisheries.

Seattle MSA and Anchorage were rated as highly engaged; however, as major cities, both are involved in multiple industries and are distinct from smaller, more remote fisheries dependent communities. Seattle MSA was added to the Community Sketches this year in an effort to capture the role of Alaska fisheries within the Seattle MSA.

The sketches will be updated yearly and additional communities of interest may be developed and presented according to feedback and decision-making needs. Given the aim of the Community Sketches, it was necessary to modify the constraints of the information slightly for certain communities. The engagement indices identified Kodiak City as one of the substantially engaged communities; however, the choice was made to include the greater Kodiak Island in the community sketch in order to give attention to the close economic, social, and governance linkages among Kodiak Island communities. Finally, confidentiality concerns required that Akutan's and King Cove's fishing engagement data be aggregated with neighboring communities in order to avoid disclosure of confidential information. For that reason, the Akutan and King Cove sketches provides information on each community, but presents aggregated fishing data from Akutan, King Cove, and Sand Point communities.

A note on taxes

In the previous ACEPO, taxes represented in the, "Current Economy," figure included values for fisheries business, fisheries landing, and raw fish taxes. For the ACEPO FY21, only municipal tax values collected from the AK Taxable Reports are used to avoid ambiguity across data reporting and collection such as, "other shared tax," and, "other tax," to reduce confusion. Sales tax values in these figures include raw fish taxes: in some cases, we cannot extrapolate these values without further research. Full values of total fish taxes (the sum of fisheries business, fisheries landing, and raw fish taxes are included in the write-up in the Current Economy section, and comparisons between these values across communities can be found in the Groundfish and Crab Fishery Tax sections earlier in this document. The, "Other Tax," values in figures as noted in the AK Taxable Reports includes such taxes as bed tax, alcohol tax, raw fish tax, etc. Because, "other taxes," are noted for including fish taxes, "other total," and, "fish taxes," are used to calculate the, "other," category that were used in community tax figures.

Community Sketch SEATTLE

Demographics (self-identified)[1]

Population	Gender population (%)	Population Over 18 (%)	Median household income ($)	White (%)	American Indian or Alaska Native (%)	Black or African American (%)	Average Age of maritime worker
737,015	49.6% female 50.4% male	85%	$97,185	61.3%	0.7%	7.0%	54

Below poverty level (%)	Housing units	Pop. Over 65 (%)	High school graduation or higher (%)	Asian (%)	Native Hawaiian or Pacific Islander (%)	Hispanic or Latino (%)
10.2%	368,308	12.5%	95.2%	17.1%	0.3%	8.2%

Area Description

The Seattle MSA is an urban conglomeration in Washington state comprised of the three most populous counties—King, Pierce, Snohomish—and includes the Pacific Northwest's largest city, Seattle. The area has long had a vital role in Alaska commercial fisheries, with 75% of Alaska's commercial fishing vessels mooring, docking, and conducting repairs in Seattle. Before Seattle and its suburbs became home to a technology industry, logging was its first major industry. Later in the 19th century, the city became the gateway to Alaska with newfound commercial and shipbuilding industries. For over 100 years, commercial fishers in Seattle have travelled to work and fish in Alaska waters.[1] Commercial fishermen use the three core facilities in the Port of Seattle including Fishermen's Terminal, Maritime Industrial Center, and Terminal 91.[2]

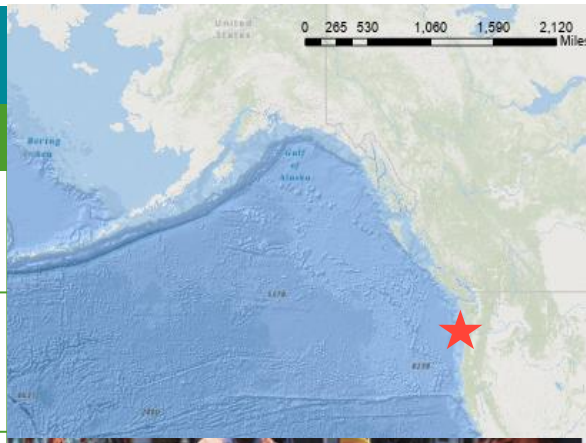
We attempted to isolate data used to the Seattle MSA to the degree possible; however in some cases accessible datasets were based on the broader Puget Sound Region. There are strong social and economic linkages across the region, however we isolated Seattle MSA data where possible

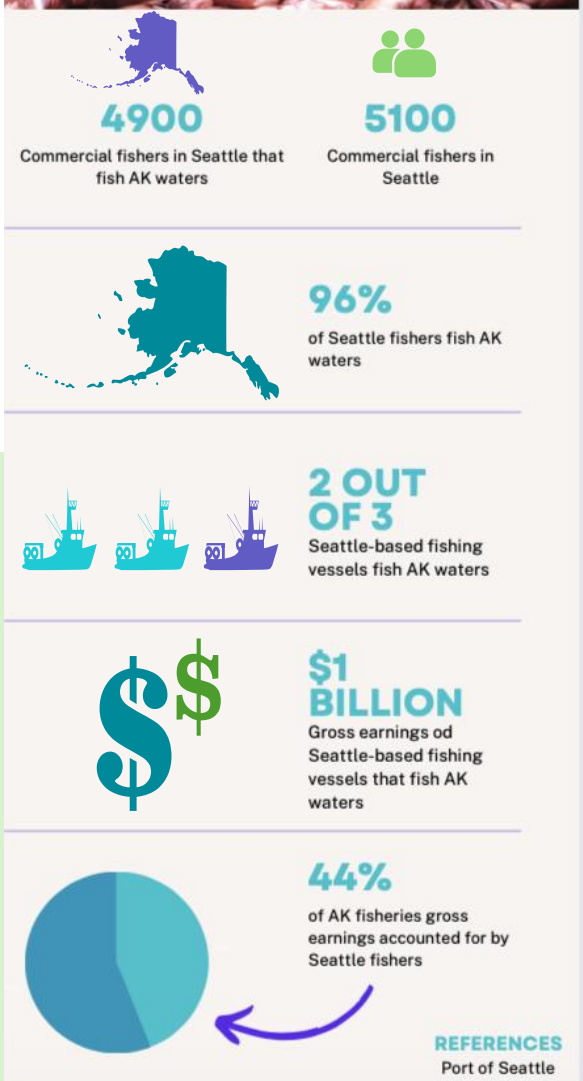
Current Economy

Seattle MSA plays an integral role in Alaska commercial fisheries. Seattle is the home port to 300 vessels with 226 of those involved in fishing Alaska waters for Pollock, Alaskan king crab, groundfish, and salmon.[2] Alaskan fisheries account for an annual harvest greater than all other U.S. states combined, adding more than $4 billion dollars in sales annually to the U.S. economy.[2] In 2017*, Seattle MSA's commercial fishing industry supplied 7,200 jobs. Of that, 5,100 individuals worked on fishing vessels, and 4,900 of those fished in Alaskan waters, supporting over $313 million in labor ($150 million in fishing employment; $163 million in onshore labor). In the same year, commercial fishing operations through the Port of Seattle generated $13.2 million in taxes in to Washington State.[3]

To gain understanding of the economic and social linkage between Seattle and Alaska fisheries, the following sections highlight: 1) seafood processing sector, 2) observer programs, 3) fleet modernization efforts, and 4) shipping operations in the Seattle MSA region. This information can provide information on how communities interact, work to support adaptation and resilience in the face of global change.

**Most recent data available was used.*



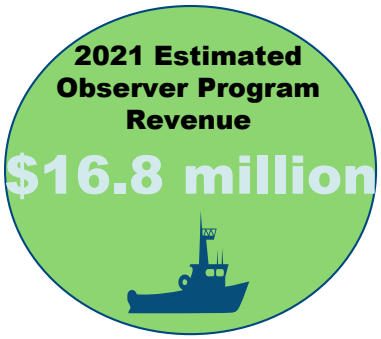


Seafood Processors

In 2020, Seattle MSA had 44 groundfish and 11 crab processors, (including both at-sea and shore-based operations). These facilities processed 1.6 billion pounds of groundfish worth $4.6 million, and 20.5 million pounds of crab worth $192 million[4] across all fisheries. Disaggregated data for total revenue from Alaska catch were not yet available; however, 96% of Seattle fishing vessels fish in Alaskan waters, and of that, 44% of Alaska commercial fisheries' gross earnings is accounted for by Seattle-based fishers.[2] Figure 2 presents the pounds of production and wholesale value of groundfish and crab processed in the Seattle MSA.[4] In order to better understand the social and economic linkages, how these connections may change with climate change, and the localized effects requires continued work with the best available disaggregated data.

Observer Programs

In addition to the many Alaska fishing vessels who dock, moor, and conduct repairs in the Seattle MSA, several organizations provide trained observers for Alaska fisheries. These entities operate out of the Seattle MSA with earnings contributing to Washington and the broader Nation's economy. For example, The North Pacific Observer Program (NPOP) began in 1990 to provide observers to vessels participating in Alaska's groundfish fishery. These observers are available year-round to meet industry coverage requirements and Federal mandates.[5] According to the 2021 North Pacific Observer Program Annual Report, Washington-based observer programs operating in Alaska fisheries contributed nearly $17 million to the Washington state economy.[6] The data used here derives from summary statistics from invoices submitted by at least three observer providers to meet confidentiality requirements.



Fleet Modernization & Maintenance

In addition to processor and observer activities conducted in Seattle MSA, fleet modernization activities contribute millions of dollars per year to Washington's economy. An estimated $800 million will be spent in fleet modernization activities in the Puget Sound between the years 2017 and 2026[7] contributing to Seattle MSA's fisheries related revenue.

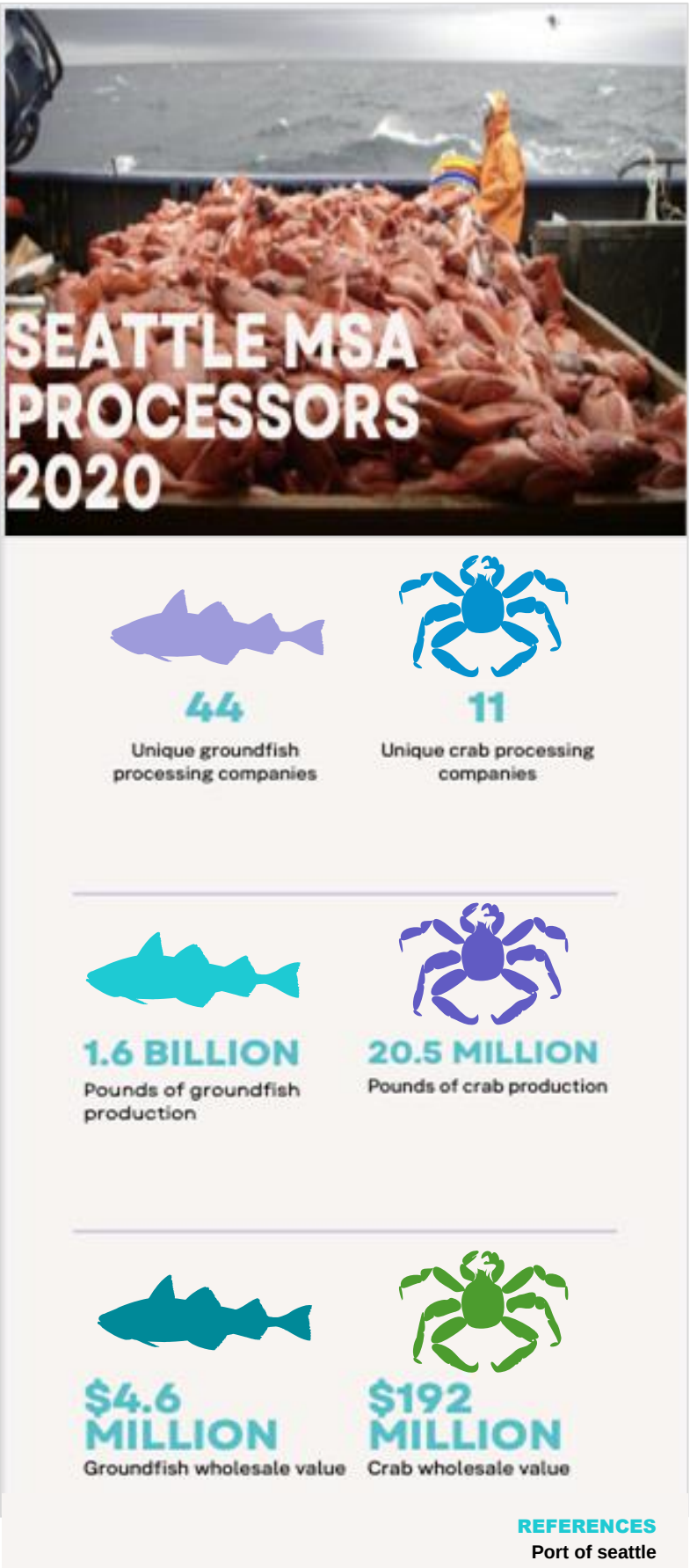


Figure 2. Seattle MSA Processor data.
Source: Commercial Operator's Annual Report.

Fishing History & Regulatory Background

For over 100 years, the Seattle fleet has fished Alaskan waters. With immigrants from Scandinavia arriving in the 1880's, these same groups brought their skills in fishing and maritime activities to the Pacific Northwest. The Puget Sound Fisheries Association Committee, which founded Fisherman's Terminal, was composed of primarily Norwegian immigrants.[8]

On January 10, 1914, over 200 fishing vessels hailed from Olympia, Washington to Alaska, marking the opening of, "Fishermen's Headquarters," known today as Fishermen's Terminal that is home to a significant North Pacific fishing fleet. [9] In the 1960s – 1980s, there was a boom in Alaska fisheries as commercial harvests decreased in other locations, many commercial fishermen from other areas ventured into Alaskan waters.

Oral history research on fishermen residing in the broader Pacific Northwest, who participate in Alaska Federal fisheries, identified factors that led them to engage in Alaska fisheries.[10] These included established social connections, expanded opportunities, sense of adventure, and economic possibilities.[10] Today, two out of three Seattle MSA vessels fish in Alaska.[2]

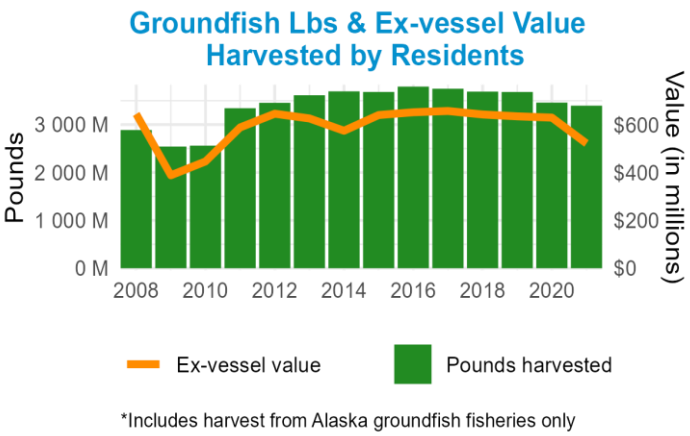
Climate Change Vulnerability & Adaptive Capacity

Due to the distinct nature of the Seattle MSA compared to other highly engaged communities, social indicators and levels of engagement have not been included for Seattle MSA's involvement in Alaska commercial fisheries. Instead, a discussion of the vulnerability and adaptive capacity to climate risk for the Seattle MSA's commercial fishing industry is included here to inform understandings of climate effects on Seattle's economy and coastal infrastructure. Finally, this section highlights several gaps in knowledge necessary to explore the adaptive capacity and climate vulnerability within Seattle MSA fisheries.

The city of Seattle is predicted to get increasingly warmer temperatures and episodes of heatwaves. Drier summers and wetter winters are also expected with increased chances of extreme precipitation events. Sea levels are expected to rise up to nine inches by the 2030s, and storm surges and high tides will periodically increase these levels.[12] The climate driven shifts in distribution and abundance of commercial fisheries in Alaska will likely affect the sustained participation of Seattle MSA in Alaska federal fisheries; however, there is a great deal of uncertainty.

The Port of Seattle has developed $1.6 billion in modernization projects and mitigation measures to address projected climate risks to the port and fisheries operations.[7,11] These efforts include increased fuel efficiency and improved processing capacity. Approximately 50% of all fleet modernization plans are expected to take place in Puget Sound. Additional research is necessary to inform climate ready fisheries.

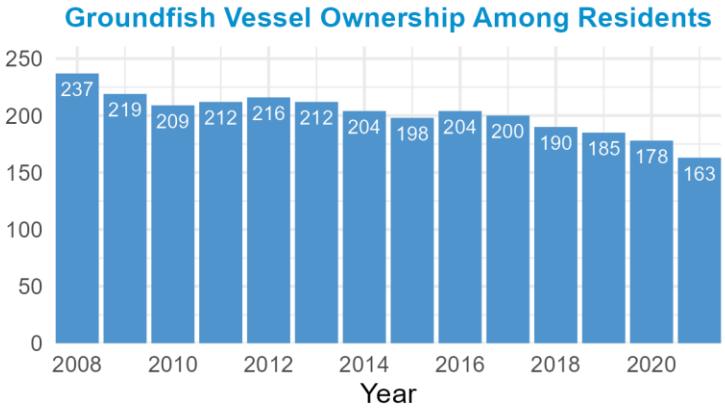
Groundfish Harvesting Engagement — HIGH



*Includes harvest from Alaska groundfish fisheries only

Seattle MSA has the highest degree of groundfish harvesting engagement in Alaskan waters over time compared to all other Alaska communities. The volume of groundfish harvested reached its peak in 2016 at almost 3.8 million pounds. Pounds of groundfish harvested began increasing significantly starting in 2011 and have remained gradually high since then. Though, there was a 286,219 pound loss or 8% decrease in pounds harvested between 2019 and 2021 that may speak to COVID-19 pandemic effects on maintaining crew, difficulties with travel, plant closures, and overall safety concerns. Meanwhile, the ex-vessel value of groundfish harvested by Seattle declined drastically from 2008 to 2009 by $256,091,529, or a 40% decline. Since 2009, Seattle has experienced a relatively gradual increase in ex-vessel value until this started gradually declining after 2017. Between 2017 and 2021, there has been a $135,478,475 or 21% decrease in ex-vessel value.

Groundfish fishing vessels owned by Seattle residents continued a slight downward trend from a peak of 237 in 2008 to 163 in 2021. The 163 vessels owned by Seattle residents in 2021 reflects an all time low since 2008. Between 2019 and 2021, there was an 12% decrease in fishing vessels owned by Seattle residents, which is the largest two year decrease included in this analysis (though only slightly greater than the 12% decrease between 2008 and 2010). This decrease is potentially linked to COVID-19 pandemic impacts.



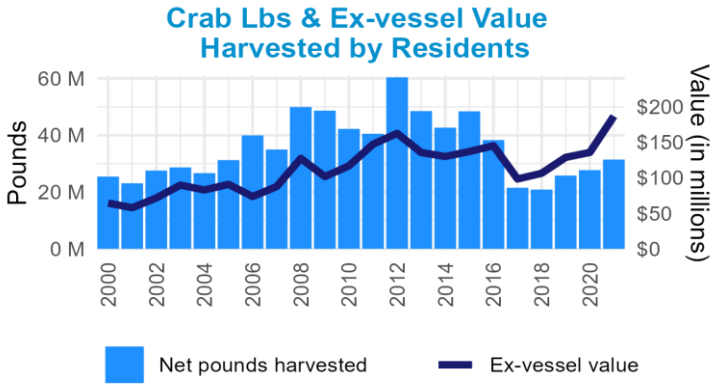
*Includes only vessels active in Alaska groundfish fisheries

Groundfish Processing Engagement — LOW

There is not a substantial amount of groundfish processing activity in Seattle to report.

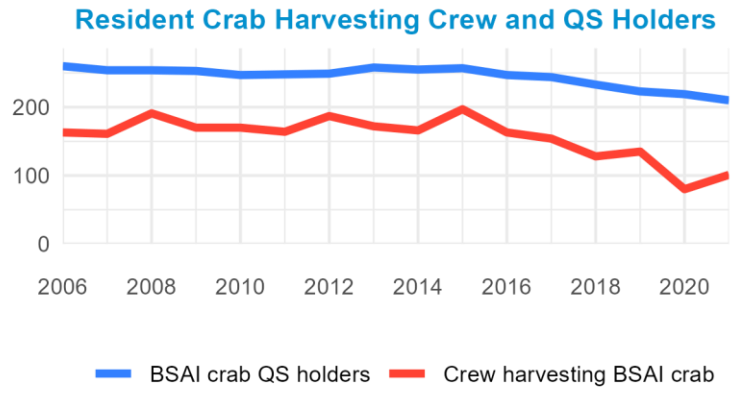
Crab Harvesting Engagement

HIGH



Seattle's resident vessels harvesting BSAI crab fisheries saw a dramatic decline in both harvest volume and associated value beginning in 2017 when harvest decreased by 17,441,359 pounds (46%) and $46.9 million (32%) from 2016 to 2018. However, the volume of crab harvested has increased by almost 10.6 million pounds or 51% between 2018 and 2021. There has been an increase of an ex-vessel value of $88.5 million (90%) between 2017 and 2021, with Seattle residents harvesting crab with an all time high ex-value of nearly $187 million in 2021.

The number of crew residing in Seattle who engage in FMP crab fisheries has decreased sharply beginning in 2020, potentially due to the COVID-19 pandemic, with a decrease in 55 crewmembers harvesting BSAI or 41% between 2019 and 2020. This number rebounded slightly in 2021 to 101 crewmembers (down from 135 in 2019).



*Includes crew and quota holders in rationalized crab fisheries only

Crab Processing Engagement — LOW

There is not a substantial amount of crab processing activity in Seattle to report.

Citations:

[1]Ott, Jennifer (2017). Fishermen's Terminal (Seattle). HistoryLink.org Essay 20488

[2]Swift, Cathy. (2019). Five Fast Facts about Commercial Fishing. Port of Seattle. Accessed 5.25.22. https://www.portseattle.org/blog/five-fast-facts-about-commercial-fishing

[3]National Marine Fisheries Service (NMFS). (2017). Fisheries Economics of the United States, 2015. U.S. Dept. of Commerce, NOAA Tech. Memo. NMFS-F/SPO-170, p.247

[4]Commercial Operator's Annual Report.

[5] Fisheries Monitoring And Analysis Division History: A history of fisheries monitoring and management in the North Pacific. NOAA Accessed 05.30.22. https://www.fisheries.noaa.gov/alaska/fisheries-observers/fisheries-monitoring-and-analysis-division-history

[6]Alaska Fisheries Science Center and Alaska Regional Office. (2021). North Pacific Observer Program 2020 Annual Report. AFSC Processed Rep. 2021-03, 143 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

[7]Modernization of the North Pacific Fishing Fleet: Economic Opportunity Analysis. (2016). McDowell Group. https://www.portseattle.org/sites/default/files/2018-03/Fleet%20Modernization%20Final%2011_11.pdf

[8]Forssblad, Marianne. (2001).Norwegians in Seattle and King County. HistoryLink.org Essay 3476. https://www.historylink.org/file/3476 .

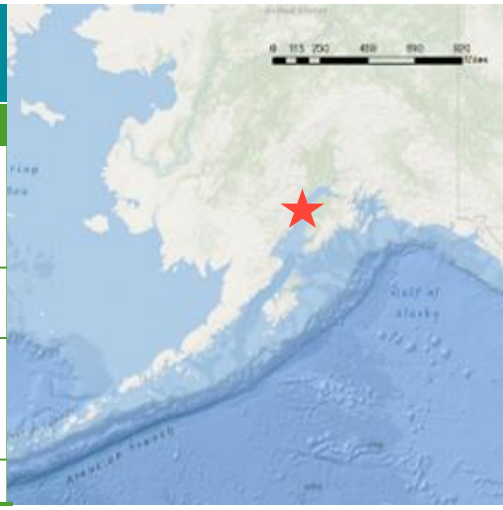
[9]Port of Seattle. Fishermen's Terminal History. https://www.portseattle.org/page/fishermens-terminal-history

[10]Kahrs, Jeffrey. (2015-2018). Commercial Fishermen Oral History Project with commercial fishers in Seattle (Collection Number: 2018.63) Museum of History & Industry, Sophie Frye Bass Library. Seattle, WA. https://archiveswest.orbiscascade.org/ark:/80444/xv988280#dscID

[11] City of Seattle. 2013. Climate Action Plan. https://www.seattle.gov/documents/Departments/Environment/ClimateChange/2013_CAP_20130612.pdf)

[12] Port of Seattle. 2016. Sea Level Rise Considerations.https://www.portseattle.org/sites/default/files/2018-03/T5_FEIS_volume_II_Appx_I.pdf

Community Sketch HOMER



Demographics (self-identified, Census 2020)

Population	Gender population (%)	Population over 18 (%)	Median household income ($)	White (%)	American Indian or Alaska Native (%)	Black or African American (%)
5,719	50.6% female 49.4% male	80.3%	$61,332	83%	6.4%	0.3%

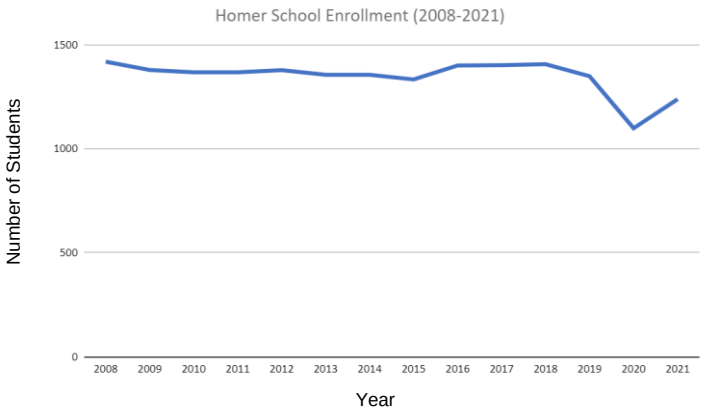
Below poverty level (%)	Housing units	Population over 65 (%)	High school graduate or higher (%)	Asian (%)	Native Hawaiian or Pacific Islander (%)	Hispanic or Latino (%)
11.4%	3,056	20.5%	94.5%	1.6%	0%	6.7%

Area Description and History

Homer is located on the north shore of Kachemak Bay on the southwestern edge of the Kenai Peninsula. Homer is located in the traditional territory of the Kenaitze people, a branch of Athabascan Native Peoples who speak Dena'ina. Today, fewer than 100 people speak this language and efforts to preserve it are led by the Tribe's Dena'ina Language and Culture Revitalization Project.[8] Historically, the Kenaitze had summer fish camps along the rivers and shores of Cook Inlet. In 1895, the U.S. Geological Survey settled in the area to study coal and gold resources and named the community after Homer Pennock, a gold mining company promoter.[2] Commercial fisheries began in the Cook Inlet in the mid 1800s with salmon and herring. Commercial exploitation of halibut and groundfish first extended into the Gulf of Alaska in the 1920s. The first year-round processing facility in Homer opened in 1954 specializing in frozen king crab and shrimp. The city government was incorporated in March 1964. Today, Homer is located in the Lower Cook Inlet state Fishery Management Area, Federal Statistical and Reporting Area 630, Pacific Halibut Fishery Regulatory Area 3A, and the Central Gulf Federal Sablefish Regulatory Area[1]. Homer is in House District 31, Senate District P. Homer was not included under the Alaska Native Claims Settlement Act (ANCSA). The Aleut Ninilchik Native Association is the primary Native Association active in the city.

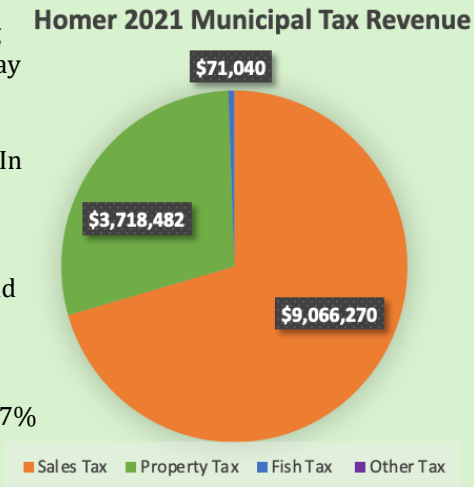
Infrastructure & Transportation

Homer is often referred to as "The End of the Road," because it lies at the terminus of the Sterling Highway. The state owns and operates the Homer Airport, which has an asphalt runway, float plane basin, and a seaplane base at Beluga Lake. The Alaska Marine Highway and local ferry services provide water transportation.[3] There are several medical facilities and eight schools in the Homer area. School enrollment has decreased 13% since 2008.[6] This has been further exacerbated by the COVID-19 pandemic. Road and other transportation access,[4] as well as the existence of schools and medical care, ensure that residents have access to necessary services and infrastructure which supports community resilience.



Current Economy

While commercial fishing has long been the mainstay of the Homer economy, tourism has become increasingly prominent.[2] In 2021, Homer generated $136,527 in total fishery related taxes (including shared and municipal) and $71,040 in raw fish taxes (municipal).[7] The overall amount of total fish taxes collected increased by 137% from 2019.[7]



These revenues support city services including education, sanitation, transportation. In 2020, per capita income was estimated to be $35,217,[8] and the median household income was estimated to be $61,332.[8] This represents an 8% and 4% increase, respectively, compared to 2018. The percentage of the population living below the poverty line has increased by 3% since 2018.[8] These measures are important for understanding the current economic wellbeing of residents and indicate potential changes in their economic security. Additionally, these factors contribute to the community's ability to adapt to stressors, such as food security and climate change.

Climate Change Vulnerability and Adaptive Capacity

Exposure to Biophysical Effects of Climate Change

A community's exposure to the biophysical effects of climate change, which include effects to the biological organisms and physical landscape surrounding them, aids in determining their vulnerability. Key biophysical impacts of climate change to the city of Homer could include rising sea levels, increased evaporation and transpiration of freshwater supplies, changes in storm frequency and intensity, and increased wildfires.[10] They are at high risk of extreme weather, coastal erosion, earthquakes, and wildfires.[11] However, overall they are at a relatively low risk of exposure to the biophysical effects of climate change compared to other communities[12]. This is in large part because sea level rise is expected to be counterbalanced by coastal uplift in this area.[13]

Dependence on Fisheries Affected by Climate Change

Reliance on fishery resources, affected by climate change, can influence how vulnerable a community is to climate driven disruption. The indices in this report indicate that the city of Homer is highly engaged in commercial fishing activities, including groundfish harvesting and processing. In 2020, and again in 2023, the Homer community experienced a closure of commercial Chinook salmon fisheries in Cook Inlet federal waters, which resulted in significant public outcry. Dip net fishing was still permitted. Homer participates in the Pacific Cod commercial fisheries and were likely impacted by the 2020 closure of the Federal Pacific cod fisheries.

Recreational and subsistence fishing also play important roles in Homer's economy and culture. Sport fishing provides an additional source of food, while the money spent by residents and nonresidents on lodging, guide services, and equipment and supply sales supports the local economy.[14] In June of this year, the Cook Inlet experienced a sport fishing closure for king salmon.[15]

Subsistence fishing is an important part of Homer's fisheries, particularly salmon and crab fisheries. While many residents have economic alternatives to subsistence fish harvests, subsistence foods offer residents cultural benefits, increased fishery options, and are often cited as one of the main attractions to living in the area.

According to 2015 research by Himes-Cornell and Kasperski, Homer is **highly dependent on fisheries resources vulnerable to the threat of climate change.**[16]As the effects of climate change continue to impact commercial, recreational, and subsistence fisheries in this region, Homer is vulnerable to economic and social disruption due to their reliance on these fisheries.

Local Adaptive Capacity

Homer has **moderate adaptive capacity limitations.**[17] This rating takes into account factors of the community which can make it harder to adapt when disruptions occur, such as: poverty levels, age of the population, unemployment rates, English language proficiency, and education level. Social indicators for Homer also indicate that poverty levels, labor force structure, population composition, and levels of personal disruption are low risk; however infrastructure in the community is moderately vulnerable to coastal hazards which therefore increases overall vulnerability.[17]

*Social Indicators for Fishing Communities**

Labor Force:	Low
Housing Characteristics:	Med.
Poverty:	Low
Population Composition:	Low
Personal Disruption:	Low

*Climate Change Vulnerability Ratings***

Exposure to Biophysical Effects:	Low
Fisheries Resource Dependence:	High
Limitations on Adaptive Capacity:	Med.

*Source: NOAA Fisheries Office of Science and Technology. 2019. NOAA Fisheries Community Social Vulnerability Indicators (CSVIs). Version 3 (Last updated December 21, 2020). https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities-0

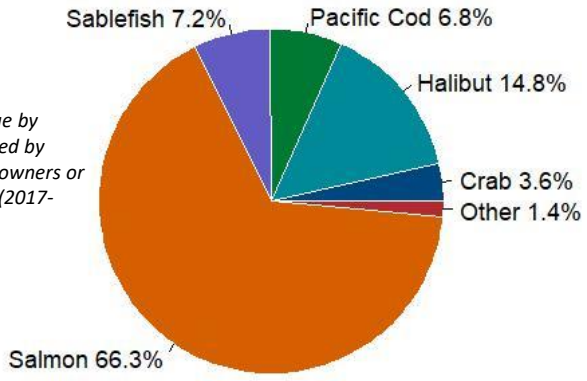
**Source: Himes-Cornell, A., & Kasperski, S. (2015). Assessing climate change vulnerability in Alaska's fishing communities. Fisheries Research, 162, 1–11. https://doi.org/10.1016/j.fishres.2014.09.010

Photo credit: Kristin Hoelting

Share of harvest revenue landed by species

Homer 2017-2021 average

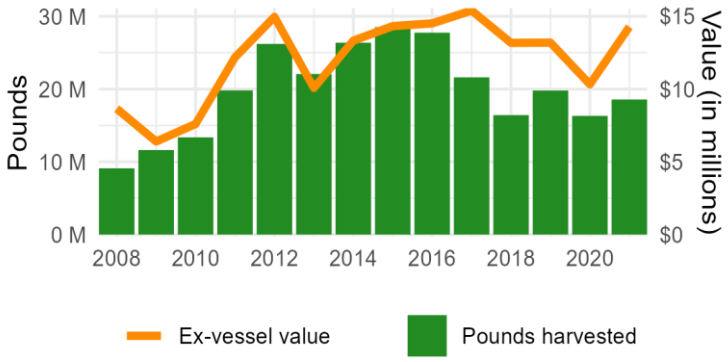
Share of revenue by species harvested by resident vessel owners or permit holders (2017-2021 average)



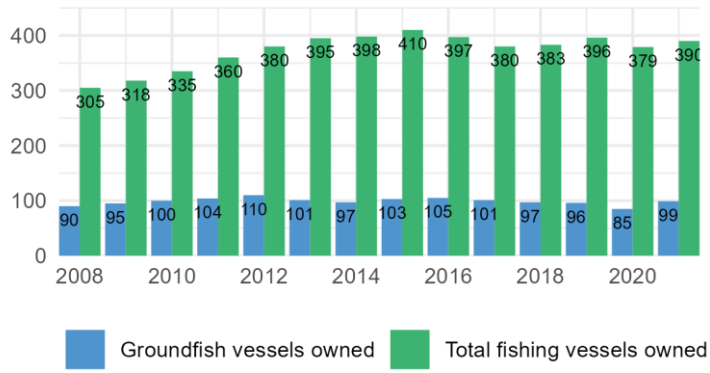
Groundfish Harvesting Engagement *HIGH*

Homer fishers are diversified in commercial fisheries, including salmon, halibut, crab, groundfish, and herring. Salmon remains the most abundant and valuable species; however, a wide range of fishing vessels use Homer as a base of fishing operations.[18] On average, from 2017-2021, the majority of harvest revenue came from salmon (66%), then halibut (15%). Fishing vessels owned by Homer residents continued a slight downward trend from a peak of 410 in 2015 to 390 in 2021 (5% decrease). A decrease of 4% occurred in 2020, potentially due to the COVID-19 pandemic, but recovered to approximate 2019 levels in 2021. In 2020, ownership of groundfish vessels was at its lowest across the entire 2008-2021 period, increasing in 2021 to 99 vessels. The pounds of groundfish harvested has steadily declined since 2016, with a sharp decline in 2020, also likely due to the COVID-19 pandemic. In 2021, however, the volume of harvest rebounded to almost 2019 levels (insert exact level). Compared to 2016, the volume harvested has decreased by 12 million pounds (40%), from 30 million (2016) to 18 million pounds (2021). Meanwhile, the ex-vessel value has only decreased by about $1 million in the same time period (from $15m to $14m).

Groundfish Lbs & Ex-vessel Value Harvested by Residents



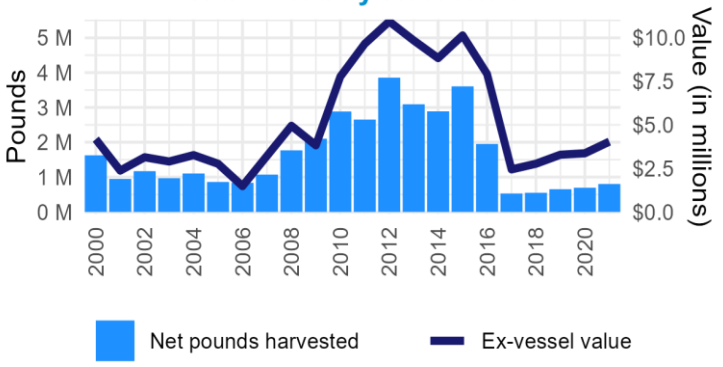
Vessel Ownership Among Residents



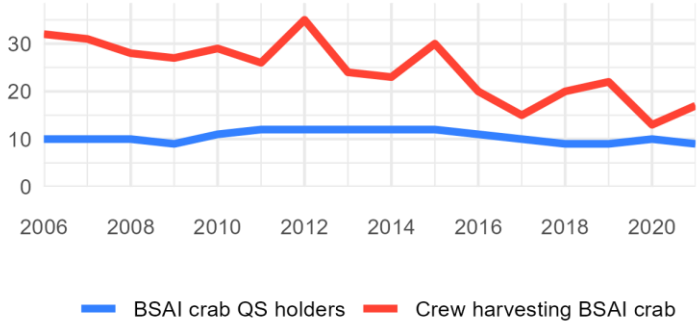
Crab Harvesting Engagement *MED*

Homer's resident vessels harvesting BSAI crab fisheries saw a dramatic decline in both harvest volume and associated revenue beginning in 2016 when harvests decreased by 1.6 million pounds (44%), and $2.2 million (22%) from 2015. In 2017, harvests fell again by 1.4 million pounds (73%) and $5.5 million in associated revenue (70%). In 2021, Homer's resident vessels harvested 800 thousand pounds of BSAI crab with a value of $4 million. Quota shareholders have remained relatively constant in the last five years, ranging from 11 (2016) to 9 (2021). The number of crew residing in Homer participating in FMP crab fisheries decreased sharply in 2020, potentially due to the COVID-19 pandemic, but rebounded slightly in 2021 to 17.

Crab Lbs & Ex-vessel Value Harvested by Residents



Resident Crab Harvesting Crew and QS Holders



*Includes crew and quota holders in rationalized crab fisheries only

Subsistence Harvesting Engagement

The residents of Homer take part in a wide range of subsistence hunting and fishing activities. While data on this community's engagement in the groundfish and crab fisheries for subsistence purposes is severely outdated, it does provide a snapshot into the historic use of these fisheries in this community. Historically, Homer residents have been highly engaged in subsistence uses of these two fisheries, particularly the crab fishery, and relied heavily on subsistence salmon.[19] In 1998, a majority of residents were engaged in subsistence fishing activities which illustrates how ubiquitous subsistence fishing has been in the area.[20]

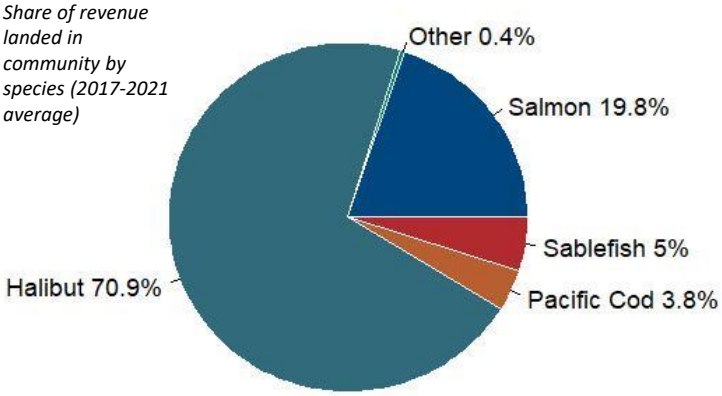
More recently, Homer has seen increasing harvests of subsistence salmon and decreasing harvests of subsistence halibut. In 2020, the number of SHARC cards issued decreased by 27% compared to 2018, which was the lowest amount ever issued in the town's history. This could be due to the COVID-19 pandemic, which likely affected residents' ability to participate. Conversely, in 2019, the number of ADFG salmon permits issued increased by 474% and was the largest amount ever issued. Compared to other communities in this report, Homer has only been moderately engaged in subsistence fishing of salmon and minimally engaged in halibut subsistence fishing within the last 5 years. However, given the sharp increase in salmon harvests in 2019, these trends could be changing and should be monitored in the future.[21, 22]

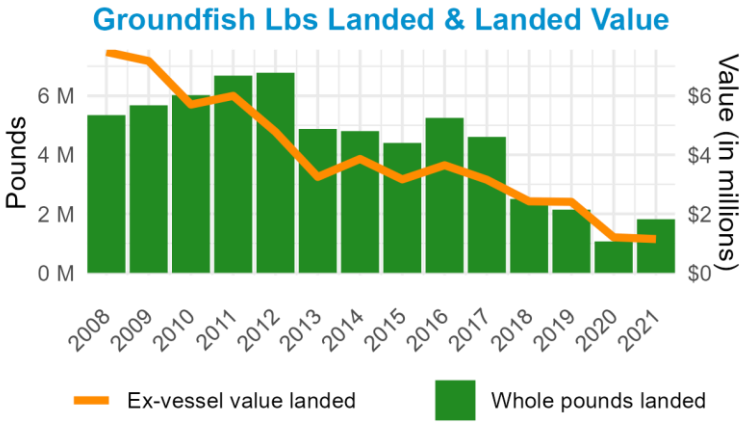
Groundfish Subsistence Homer (1982)*	Crab Subsistence Homer (1982)*
14.4% Households using at least one species**	65.3% Households using at least one species**
1.7% Households receiving at least one species**	45.1% Households receiving at least one species**
8,001 Total pounds harvested	17,164 Total pounds harvested
1.42 Pounds per capita harvested	7.62 Pounds per capita harvested
**Species include bottomfish other halibut, such as cod, flounder, rockfish or sole	**Includes all harvestable crab species

*All subsistence information is from the Community Subsistence Information System, ADFG. This reflects the most recent data available. While some data are well in the past, they still reflect important information on subsistence activities within the community. These data will be updated as is available.

GF Processing Engagement — *MED-HIGH*

Share of revenue landed in community by species (2017-2021 average)



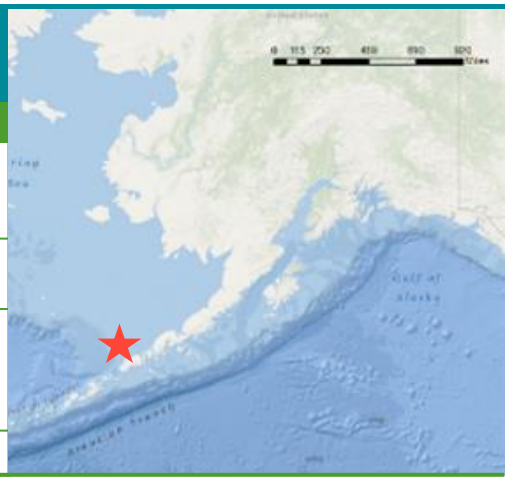


Although halibut dominates the processing sector (accounting for 70.9% of landed value on average from 2017-2021) Homer is one of the leading groundfish processing communities in Alaska. In 2021, Homer's processing sector processed 1.8 million pounds of groundfish with an associated value of $1.3 million. In 2019, both landings volume and associated value showed a decline of 294,380 pounds (down 13%) and $1 million in revenue (down 43%). Both also dropped significantly during the 2020 COVID-19 pandemic, and rebounded somewhat in 2021. Pacific cod showed the largest decline, with volume dropping 1.7% compared to 2019 and 62% in associated value. Sablefish also showed decreases in volume and value. In 2021, groundfish comprised 20% of total volume processed in Homer, a steady decline since 2017, and just 3% of processing revenue. The number of processors fell slightly in 2020 to just 62, potentially due to the COVID-19 pandemic, but rose to 2019 levels in 2021 with 77 processors.

Crab Processing Engagement — *LOW*

There is not a substantial amount of crab processing activity in Homer to report.

Community Sketch AKUTAN



Demographics (self-identified, 2020 ACS)

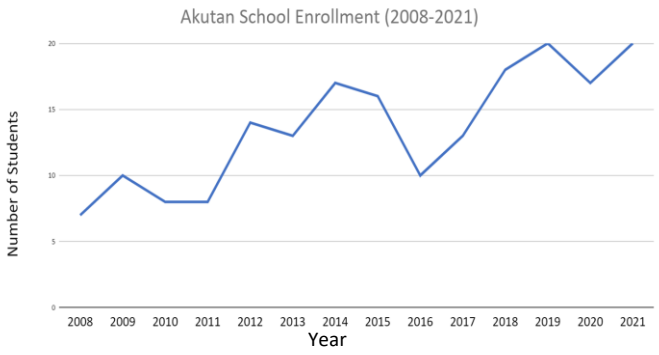
Population	Gender population (%)	Pop. Under 5 (%)	Median household income ($)	White (%)	American Indian or Native Alaskan	Black or African American (%)
760	31.7% female 68.3% male	2.5%	$34,583	15.3%	23.4%	12.8%
Below poverty level (%)	**Housing units**	**Pop. Over 85 (%)**	**High school graduate or higher (%)**	**Asian (%)**	**Native Hawaiian or Pacific Islander (%)**	**Hispanic or Latino (%)**
23.3%	80	0.8%	83.3%	29.6%	0.0%	19.1%

Area Description and History

Akutan is located on Akutan Island, one of the Krenitzin Islands of the Fox Island group in the eastern Aleutians. Located 35 miles east of Unalaska and 766 miles southwest of Anchorage, the area occupies 14m^2 of land and 4.9m^2 of water. Historically, the Aleut people, the original inhabitants of the island, harvested salmon, cod, herring, and other species around Akutan. Subsistence harvest continues to be important. Commercial fisheries began in the late 1800s, and today Akutan is one of the busiest fishing ports in the world.[3] In 1878, Akutan became a fur storage and trading port for the Western Fur & Trading Company; and the Pacific Whaling Company built a whale processing station across the bay from Akutan in 1912. Crab fisheries began in 1930 and accelerated in size and scope in the 1950s, when king crab fisheries developed in the Bering Sea. King crab harvests peaked in the 1970s and early 1980s. Today, crab harvests have declined dramatically. Akutan's proximity to the Bering Sea brought the processing industry in the late 1940s including both floating and shore-based processors.[1] Akutan was incorporated as a second-class city in 1979 and is under the jurisdiction of the Aleutians East Borough. The Akutan community comprises two distinct subgroups: about 100 year round residents, and seasonal processing plant employees who live in group quarters. There is a Community Development Quota program (represented by the Aleutian Pribilof Islands Community Development Association).[2] The Akutan Corporation, the Aleut Corporation, and the Aleutian Pribilof Islands Association are the main Native associations. Akutan is located in Federal Reporting Area 519, International Pacific Halibut Commission (IPHC) Regulatory Area 4B, and the Aleutian Islands Sablefish Regulatory Area.

Infrastructure & Transportation

Akutan's airport opened in 2012 and is located seven miles east on Akun Island, servicing the community by helicopter. The state ferry serves Akutan biweekly from May to September. Akutan has a 100-foot public dock and a 58-vessel mooring basin. Trident Seafoods owns several commercial docks.[1] Water derives from a stream and dam constructed in 1927, and a community septic tank treats sewage before discharge.[3] Electricity relies on hydropower with diesel backup. Household heating relies on fuel oil and kerosene. The one school, provides K-12 education. School enrollment increased 186% from 2008 to 2021, likely due to the increase in processing employment.[4] There was a 15% decrease in student enrollment between 2019 to 2020,[4] which is likely due reflecting change sassociated with the COVID pandemic.



Current Economy

Akutan's economy is primarily based on commercial fishing and subsistence harvest. Subsistence is vitally important to the community as a source of food and cultural identity. The Trident Seafoods' Akutan plant is the largest seafood production facility in North America, processing over three million pounds of product per day and capable of housing up to 825 employees.[1] In 2021, Akutan generated $1,031,674 in total fishery related taxes (including shared and municipal). The overall amount of total fish taxes collected did not increase from 2019.[5] These revenues support basic city services such as education, sanitation, transportation, etc. and are important indicators of community health and wellbeing. In 2020, per capita income in Akutan was estimated to be $34,274,[6] and the median household income was estimated to be $34,583.[6] This represents a 10.4% and 29.3% increase in these measures respectively compared to 2018.[5] However, the percentage of the population living below the poverty line has increased by 4.3% since 2018.[6]

Climate Change Vulnerability and Adaptive Capacity

Exposure to Biophysical Effects of Climate Change

A community's exposure to the biophysical effects of climate change, which include effects to the biological organisms and physical landscape surrounding them, aids in evaluating their vulnerability. The Aleutian islands are expected to experience increased temperatures and precipitation, and increased summer storminess. Similar to other Alaskan communities, they will be impacted by reduced sea ice as well.[7] However, overall compared to other communities in Alaska, Akutan is at a relatively **low risk of exposure to the biophysical effects** of climate change.

Dependence on Fisheries Impacted by Climate Change

Reliance on fisheries resources, which are being impacted by climate change, can determine how vulnerable a community is to disruption from climate change. Akutan, according to the indices in this report, is highly engaged in processing for the groundfish and crab fisheries. In addition, while residents are not as universally engaged in subsistence fishing as other communities, a significant portion do still engage with subsistence fisheries for staple resources such as cod, halibut and salmon which provide additional sources of nutrition in their diets.

Given these measures, Akutan is overall **highly dependent on fisheries resources** which will be impacted by climate change**.** As these fisheries continue to change, Akutan residents are vulnerable to disruptions which will affect their livelihoods and subsistence activities. For instance, in 2022, the sablefish fishery in the Aleutian Islands state waters closed early in August.[9] While it is unclear to what extent this closure impacted Akutan residents, it is important to be aware of recent closures that could cause impacts given the community's high reliance on commercial fishing.

Local Adaptive Capacity

Akutan overall has a very **high limitations on its adaptive capacity**. This rating takes into account factors in the community which can make it harder to adapt when disruptions occur. Akutan's high rating is due to highly vulnerable housing and infrastructure. There are medium rates of poverty and a population that contains many individuals who are more vulnerable to shocks and disasters, including individuals who live or work in less stable conditions. In addition, the FEMA National Risk Index identified that the Aleutians East region has very low levels of community resilience.[8] Therefore, if Akutan residents are biophysically impacted by climate change, and when the fisheries resources they rely on are impacted, adaptive capacity is limited.

*Social Indicators for Fishing Communities**

Labor Force:	Low
Housing Characteristics:	High
Poverty:	Med.
Population Composition:	High
Personal Disruption:	Med.

*Climate Change Vulnerability Ratings***

Exposure to Biophysical Effects:	Low
Fisheries Resource Dependence:	High
Limitations on Adaptive Capacity:	High

*Source: NOAA Fisheries Office of Science and Technology. 2019. NOAA Fisheries Community Social Vulnerability Indicators (CSVIs). Version 3 (Last updated December 21, 2020). https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities-0

**Source: Himes-Cornell, A., & Kasperski, S. (2015). Assessing climate change vulnerability in Alaska's fishing communities. Fisheries Research, 162, 1–11. https://doi.org/10.1016/j.fishres.2014.09.010

Subsistence Harvesting Engagement

Residents of Akutan regularly engage in subsistence fishing activities.[10] The most popular species of groundfish harvested are cod and rockfish. In total, a very significant number of pounds per capita of groundfish were harvested in 2008, the most recent year data was available.[11] This indicates that subsistence fishing provides an important nutritional source to residents. While recorded numbers of halibut harvested fluctuated in recent years, data from a subsistence harvesting study conducted in 2015 shows that halibut, salmon and cod are all staple subsistence foods in Akutan and comprise 76% of the major subsistence resources harvested by residents.[12] Subsistence salmon harvest data from the Alaska Department of Fish and Game was not available for Akutan, however the subsistence study shows that salmon make up an important part of subsistence harvests there. Between 1991 and 2016, the estimated pounds of salmon harvested varied depending on availability, ranging from 1,000 to more than 18,000 pounds. Residents have also historically harvested a wide variety of species, but this has declined since 2008 as the species harvested and used have become more narrowed.[11]

Groundfish Subsistence
Akutan (2008)*

36.1%
Households using at least one species**

22.2%
Households receiving at least one species**

1,584
Total pounds harvested

19.27
Pounds per capita harvested

****Species include Cod, Walleye Pollock, Flounder, Greenling, Atka Mackerel, Rockfish, Sablefish, Sculpin, and Sole**

Crab Subsistence
Akutan (2008)*

36.1%
Households using at least one species**

36.1%
Households receiving at least one species**

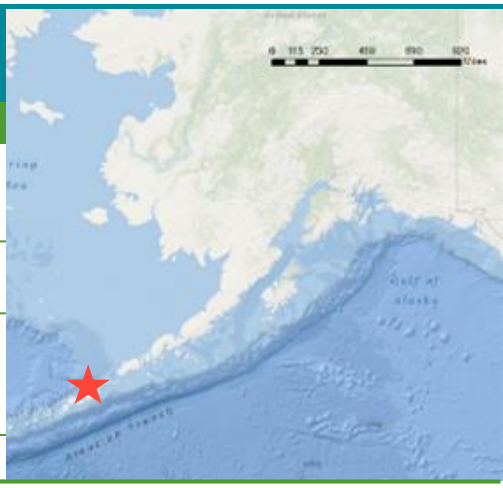
5.1
Total pounds harvested

0.06
Pounds per capita harvested

****Species include Dungeness Crab, Tanner Crab, Hair Crab, and King Crab**

*All subsistence information is from the Community Subsistence Information System (CSIS), ADFG. The CSIS is a repository of Alaska community harvest information gathered on the household level by ADFG, Division of Subsistence. This reflects the most recent data available. While some data are well in the past, they still reflect important information on subsistence activities within the community. These data will be updated as is available.

Community Sketch KING COVE



Demographics (self-identified, 2020 ACS)

Population	Gender population (%)	Population Under 5 (%)	Median household income ($)	White (%)	American Indian or Alaska Native (%)	Black or African American (%)
1,147	42.5% female 57.5% male	4.4%	$71,875	10.8%	51.4%	1.3%

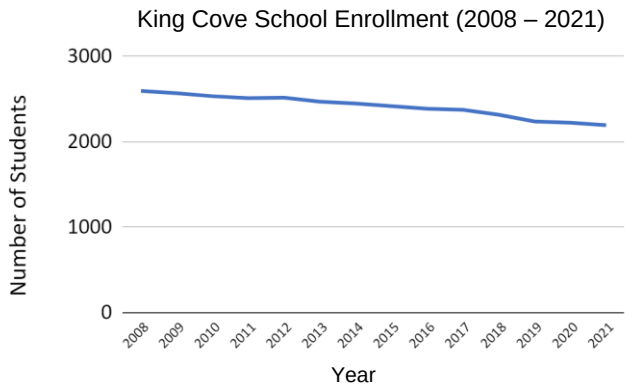
Below poverty level (%)	Housing units	Population Over 85 (%)	High school graduate or higher (%)	Asian (%)	Native Hawaiian or Pacific Islander (%)	Hispanic or Latino (%)
18.6%	386	3.5%	85.1%	24.4%	0%	6.5%

Area Description and History

King Cove (also known as Agdaaĝux̂ in Aleut) is located on the south side of the Alaska Peninsula, 18 miles southeast of Cold Bay and 625 miles southwest of Anchorage. It is located in the midst of a storm corridor, which often brings extreme fog and high winds. Historically, the Aleut people, the original inhabitants of the island, harvested salmon, cod, herring, and other species around King Cove. Subsistence harvest continues to be important among the island's Native population today. Unangam tunuu was the language traditionally spoken, however, today only about 109 individuals speak this language.[1] In 1911, Pacific American Fisheries built a salmon cannery, and in 1949, the city of King Cove was incorporated. The first settlers were Scandinavian, European, and Unangan fishermen. Year round residents are largely Aleutic, with a large influx of temporary workers in March and again in June and July, driven by seafood processing employment. King Cove was included under the Alaska Native Claims Settlement Act (ANCSA), and is federally recognized as a Native Village. The Agdaaĝuxˆ Aleutian Pribilof Islands Association is the main Native Association active there today.

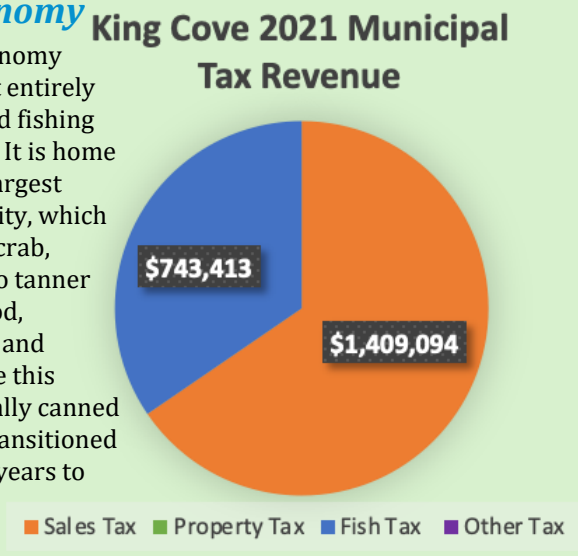
Infrastructure & Transportation

King Cove is accessible only by air and sea. A state-owned 3,360 foot gravel runway is available for flights. The State Ferry operates monthly between May and October, and uses one of three available docks. A deep water dock is also operational. The North Harbor provides moorage for 90 boats, and is ice-free all year. A new harbor and breakwater is under construction by the Corps of Engineers and Aleutians East Borough. Once completed, a new harbor will be operated by the City, and will provide additional moorage for 60′ to 150′ vessels.[2] According to the municipality, all King Cove residents are connected to a water pipeline supplied by Ram Creek. King Cove is one of the leaders of renewable energy in rural Alaska, with hydroelectric facilities on the Delta Creek and more recently, the Waterfall Creek hydro facility in 2017.[3] The landfill is nearing capacity with plans to expand solid waste infrastructure from a USDA grant announced in 2018.[4] There is one local health clinic. There is one school in King Cove and enrollment has decreased by 32.7% from 2008-2



Current Economy

King Cove's economy depends almost entirely upon year round fishing and processing. It is home to Peter Pan's largest processing facility, which processes king crab, bairdi and opilio tanner crab, pollock, cod, salmon, halibut and black cod. While this facility historically canned salmon it has transitioned in more recent years to whitefish operations.[6]



The plant employs around 500 employees year round.[6] Residents continue to participate in subsistence harvest of marine resources. In 2021, King Cove generated $1,178,902 in total fishery related taxes (including shared and municipal).[7] The overall amount of total fish taxes collected in 2021 decreased by 14.9% from 2019.[7] These revenues support basic city services such as education, sanitation, transportation, etc. and are important indicators of community health and wellbeing. In 2020, per capita income in King Cove was estimated to be $34,690,[8] and the median household income was estimated to be $71,875.[8] This is an 11% increase and a 1.8% decrease in these measures respectively compared to 2018. However, the percentage of the population living below the poverty line has increased by 5% since 2018.[8]

Climate Change Vulnerability and Adaptive Capacity

Exposure to Biophysical Effects of Climate Change

A community's exposure to the biophysical effects of climate change, which include effects to the biological organisms and physical landscape surrounding them, aids in evaluating their vulnerability. The Aleutian islands are expected to experience increased temperatures and precipitation, and increased summer storm events. Similar to other Alaskan communities, they will be impacted by reduced seasonal sea ice coverage as well.[9] Compared to other communities in Alaska, King Cove is at a relatively **low risk of exposure to the biophysical effects** of climate change.

Dependence on Fisheries Impacted by Climate Change

Reliance on fisheries resources affected climate change can determine how vulnerable a community is to disruption from climate change. King Cove is highly engaged with commercial processing within the groundfish and crab fisheries. In addition, their subsistence harvesting engagement is very high (salmon in particular), and moderately high for groundfish and crab species. Overall, subsistence activities play a very important role in cultural characteristics and food security. Factors such as warming oceans and changing weather patterns have been noted by residents as affecting their harvests of salmon in particular.[10] In 2022, the sablefish fishery in the Aleutian Islands state waters closed early in August.[11] Given these measures, King Cove can be considered highly dependent on fisheries resources which will be impacted by climate change**.** As climate driven effects on fisheries continue, King Cove residents will be vulnerable to disruptions in livelihoods and subsistence activities. Climate effects on fisheries may cause broader social disruption given the community's high reliance on commercial fishing and subsistence activity.

*Social Indicators for Fishing Communities**

Labor Force:	Low
Housing Characteristics:	Med-High
Poverty:	Med.
Population Composition:	High
Personal Disruption:	Med.

*Climate Change Vulnerability Ratings***

Exposure to Biophysical Effects:	Low
Fisheries Resource Dependence:	High
Limitations on Adaptive Capacity:	High

*Source: NOAA Fisheries Office of Science and Technology. 2019. NOAA Fisheries Community Social Vulnerability Indicators (CSVIs). Version 3 (Last updated December 21, 2020). https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities-0

**Source: Himes-Cornell, A., & Kasperski, S. (2015). Assessing climate change vulnerability in Alaska's fishing communities. Fisheries Research, 162, 1–11. https://doi.org/10.1016/j.fishres.2014.09.010

Local Adaptive Capacity

King Cove overall has very **high limitations on its adaptive capacity**. This rating accounts for factors in the community which can make it more difficult to adapt to climate driven disruptions. King Cove's high rating is due to housing and infrastructure being moderately to highly vulnerable, medium poverty levels, a portion of the population who are more vulnerable to shocks and disasters. In addition, the FEMA National Risk Index identified that the Aleutians East region has very low levels of community resilience.[12] King Cove residents have limited capacity to adapt to climate risks and recover rapidly.

Subsistence Harvesting Engagement

Residents of King Cove are moderately engaged in subsistence fishing activities within the groundfish and crab fisheries. Cod is the most utilized groundfish species by far, while King Crab and Tanner Crab are the most popular crab species. Compared to other communities, their harvested pounds per capita are on the lower end, however they have been highly stably engaged in halibut and salmon subsistence fishing. A study conducted by the Alaska Sustainable Salmon Fund in 2016 showed that the harvesting, processing, sharing and consumption of salmon, especially sockeye, was culturally essential for King Cove residents. While many residents still used traditional subsistence methods, many households had also begun meeting their subsistence needs by removing salmon for home use from their commercial harvests. In King Cove, nearly all households (91%) were found to use salmon, with 75% attempting to harvest and 59% receiving salmon from others. Overall, it was the most widely utilized wild resource by pounds. Changes and weather patterns, rising sea levels, and warming oceans were some of the environmental factors which had recently impacted residents' ability to harvest salmon. However, economic and social factors, such as access to funds to buy equipment and the influence of local canneries, also affected residents' harvest patterns.[13, 14]

Groundfish Subsistence
King Cove (2016)*

37.3%
Households using at least one species**

21.9%
Households receiving at least one species**

1,831
Total pounds harvested

4.23
Pounds per capita harvested

****Species include Cod, Walleye Pollock, Flounder, Greenling, Atka Mackerel, Rockfish, Sablefish, Sculpin, and Sole.**

Crab Subsistence
King Cove (2016)*

51.6%
Households using at least one species**

46.1%
Households receiving at least one species**

1,152
Total pounds harvested

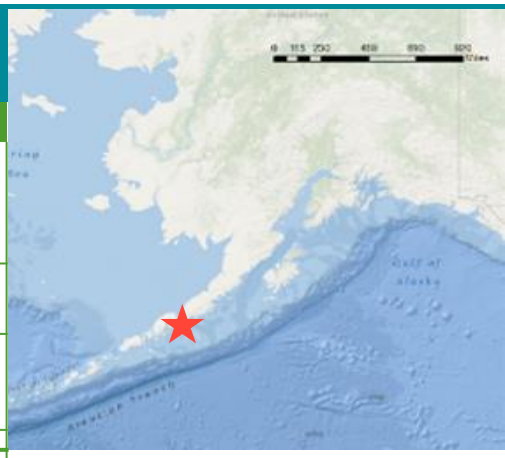
2.18
Pounds per capita harvested

****Species include Dungeness Crab, Tanner Crab, Hair Crab, and King Crab.**

*All subsistence information is from the community Subsistence Information System (CSIS), ADFG. The CSIS is a repository of Alaska community harvest information gathered on the household level by ADFG, Division of Subsistence. This reflects the most recent data available. While some data are well in the past, they still reflect important information on subsistence activities within the community. These data will be updated as is available.

Community Sketch

SAND POINT



Demographics (self-identified, 2020 ACS)

Population	Gender population (%)	Population Under 5(%)	Median household income ($)	White (%)	American Indian or Alaska Native (%)	Black or African American (%)
1,186	46.2% female 53.8% male	2.5%	$85,833	15.9%	40.4%	1.3%

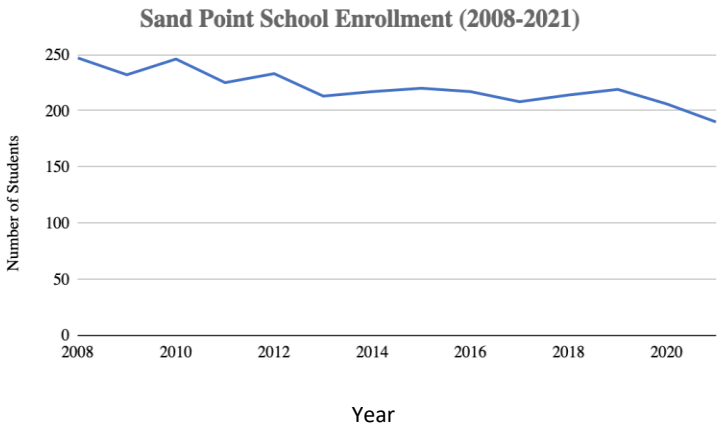
Below poverty level (%)	Housing units	Population Over 85 (%)	High school graduate or higher (%)	Asian (%)	Hawaiian Native or Pacific Islander (%)	Hispanic or Latino (%)
9.6%	482	0.2%	89.3%	19.8%	0.9%	5.5%

Area Description and History

Sand Point, also known as Qagun Tayagungin, is situated on Popof Island, off the southern coast of the Alaska Peninsula. Prior to the arrival of Europeans, the population of Aleuts in the region is estimated to have ranged between 12,000-20,000 people. Historically, the Aleut people harvested salmon, cod, herring, and other species around Sand Point. Following arrival, the population of Aleuts declined by 80-90% as a result of disease, warfare, malnutrition, and forced labor as sea otter hunters. The Aleut people traditionally spoke Unangam tunuu, however today only about 109 individuals speak this language.[1] The settlement of Sand Point was founded in 1898 as a cod fishing outpost and incorporated in 1946. Sand Point is home to one of the largest fishing fleets in the Aleutian Chain. Fisheries employs a number of seasonal workers each year. Included under the Alaska Native Claims Settlement Act (ANCSA), Sand Point was has three native tribes: The Qagan Tayagungin Tribe of Sand Point Village, the Native Village of Unga, and Pauloff Harbor Village. The main Native Associations and Corporations active in the area include: Qagan Tayagungin Tribe, Unga Tribe, Pauloff Harbor Tribe, Shumagin Corporation, Unga Corp., and Sanak Corp.

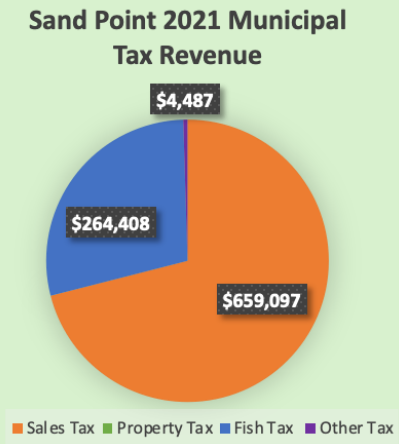
Infrastructure & Transportation

Sand Point has an airport with a 5,200 feet paved runway and daily flights to Anchorage. Marine facilities include a 25-acre boat harbor with four docks, 134 boat slips, a harbormaster office, barge off-loading area, and a 150-ton lift. Regular barge services supply the community. The state ferry operates between Sand Point and Unalaska, Akutan, False Pass, Cold Bay, and King Cove between May and October. Medical services are provided by the Sand Point Community Health Clinic. At the Aleutians East Borough Schools located in Sand Point, student enrollment has decreased by 23% since 2008, and between 2019 and 2020, Sand Point experienced a 6% decrease in school enrollment [2] likely linked driven by the effects of the COVID pandemic.



Current Economy

Sand Points' economy is primarily based on commercial fishing and processing, with Trident Seafoods being a top employer. In addition to the seafood industry, local employers in Sand Point include the Aleutians East Borough School District, local government offices, the Shumagin Corporation, Peninsula Airways, and the State of Alaska. In 2021, Sand Point generated $422,759 in total fishery related taxes (including shared and municipal). The overall amount of total fish taxes collected in 2021 decreased by 32.1% from 2019. [3] These revenues support basic city services such as education, sanitation, transportation, etc. and are important indicators of community health and wellbeing. In 2020, per capita income in Sand Point was estimated to be $37,722,[4] and the median household income was estimated to be $85,833.[4] This represents a 16.9% increase and a 27% increase in these measures respectively compared to 2018.[4] However, the percentage of the population living below the poverty line has decreased by 5% since 2018.[4]



Climate Change Vulnerability and Adaptive Capacity

Exposure to Biophysical Effects of Climate Change

A community's exposure to the biophysical effects of climate change, which include effects to the biological organisms and physical landscape surrounding them, aids in determining their vulnerability. The Aleutian islands are expected to experience increased temperatures and precipitation, and increased summer storminess. Similar to other Alaskan communities, they will be impacted by reduced sea ice as well.[5] However, overall compared to other communities in Alaska, Sand Point is at a relatively **low risk of exposure to the biophysical effects** of climate change.

Dependence on Fisheries Impacted by Climate Change

Reliance on fisheries resources which are being impacted by climate change can determine how vulnerable a community is to disruption from climate change. Sand Point, according to the indices in this report, is highly engaged with commercial processing within the groundfish and crab fisheries. In addition, their subsistence harvesting engagement is also high, with 61% of residents utilizing at least one groundfish species, and 53% utilizing at least one crab species. They also heavily rely on harvests of salmon for subsistence and cultural purposes. However, residents have noted how changes in the climate have recently impacted their ability to harvest salmon. This is reflected in a 84% decrease in salmon harvests in Sand Point since 2015.[6]

Given these measures, Sand Point is overall **highly dependent on fisheries resources** which will be impacted by climate change**.** As these fisheries continue to respond to a changing climate, Sand Point residents are vulnerable to disruptions which will affect their livelihoods and subsistence activities. For instance, in 2022, the sablefish fishery in the Aleutian Islands state waters closed early in August.[8] While it is unclear to what extent this closure impacted Sand Point residents, it is important to be aware of recent closures that could cause impacts given the community's high reliance on commercial fishing.

*Social Indicators for Fishing Communities**

Labor Force:	Low
Housing Characteristics:	Med-High
Poverty:	Med.
Population Composition:	High
Personal Disruption:	Med.

*Climate Change Vulnerability Ratings***

Exposure to Biophysical Effects:	Low
Fisheries Resource Dependence:	High
Limitations on Adaptive Capacity:	High

*Source: NOAA Fisheries Office of Science and Technology. 2019. NOAA Fisheries Community Social Vulnerability Indicators (CSVIs). Version 3 (Last updated December 21, 2020). https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities-0

**Source: Himes-Cornell, A., & Kasperski, S. (2015). Assessing climate change vulnerability in Alaska's fishing communities. Fisheries Research, 162, 1–11. https://doi.org/10.1016/j.fishres.2014.09.010

Local Adaptive Capacity

Sand Point overall has **very high limits to its adaptive capacity**. This rating takes into account factors in the community which can make it harder to adapt when disruptions occur such as: poverty level, age of the population, unemployment rates, English language proficiency, and education level. Sand Point's received a high rating because housing and infrastructure are moderately to highly vulnerable to natural disasters and a population that contains many individuals who are more vulnerable to shocks and disasters, and many individuals who live or work in less stable conditions. In addition, the FEMA National Risk Index identified that the Aleutians East region has very low levels of community resilience.[7] Therefore, if Sand Point residents are biophysically impacted by climate change, their capacity to adapt to these changes and recover rapidly is limited.

Subsistence Harvesting Engagement

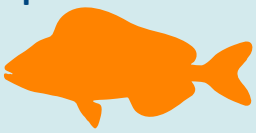
Residents of Sand Point rely heavily on certain species of groundfish for subsistence purposes, particularly cod and rockfish. They also rely heavily on crab species, including dungeness and king crab. According to Alaska Dept. of Fish and Game data, their subsistence harvests of halibut have increased since 2012, while their harvests of salmon have decreased[6,10]. This is concerning, given that a study conducted by the Alaska Sustainable Salmon Fund in 2016 showed that the harvesting, processing, sharing and consumption of salmon, especially sockeye, was culturally essential for Sand Point residents. While many residents still used traditional subsistence methods, many households had also begun meeting their subsistence needs by removing salmon for home use from their commercial harvests. This study also showed that nearly every household in Sand Point (97%) used salmon, with 68% of households attempting to harvest and 66% receiving salmon from others. In recent years, changes in weather patterns, rising sea levels, and warming oceans were some of the environmental factors which had impacted residents' ability to harvest salmon. Economic and social factors, such as access to funds to buy equipment and the influence of local canneries, also affected residents' harvest patterns.[9]

Groundfish Subsistence
Sand Point (2016)*

61.4%
Households using at least one species**

39.6%
Households receiving at least one species**

5,911
Total pounds harvested



11.61
Pounds per capita harvested

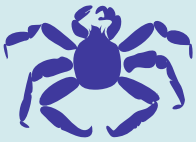
****Species include Cod, Walleye Pollock, Flounder, Greenling, Lingcod, Atka Mackerel, Rockfish, Sablefish, Sculpin, and Sole**

Crab Subsistence
Sand Point (2016)*

53.5%
Households using at least one species**

40.6%
Households receiving at least one species**

1,238
Total pounds harvested



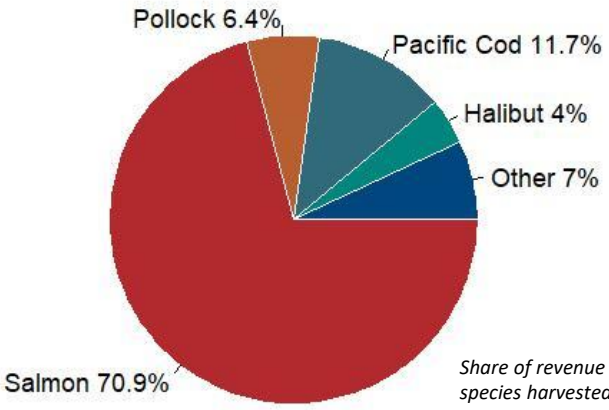
2.43
Pounds per capita harvested

****Species include Dungeness Crab, Tanner Crab, Hair Crab, and King Crab**

*All subsistence information is from the Community Subsistence Information System (CSIS), ADFG. The CSIS is a repository of Alaska community harvest information gathered on the household level by ADFG, Division of Subsistence. This reflects the most recent data available. While some data are well in the past, they still reflect important information on subsistence activities within the community. These data will be updated as is available.

Share of harvest revenue landed by species

Akutan, Sand Point, King Cove combined 2017-2021 average



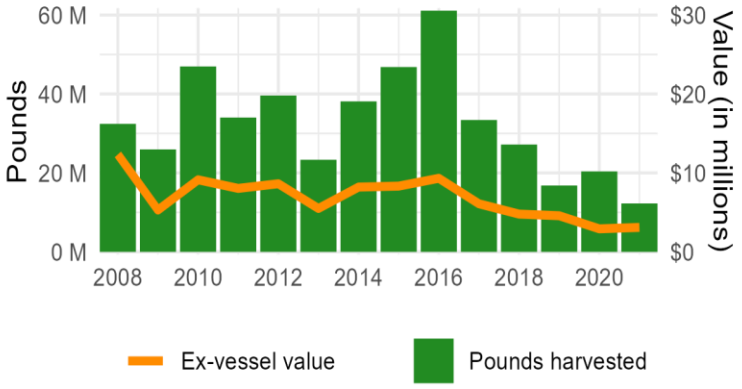
Share of revenue by species harvested by resident vessel owners or permit holders (2017-2021 average). data are aggregated across Akutan, Sand Point, and King Cove due to confidentiality.

GF Harvesting Engagement — LOW

Due to the small number of participants, some data are considered confidential. For this reason, data were aggregated to include adjacent communities within the Aleutians East Borough (AEB): Akutan, Sand Point, and King Cove communities.

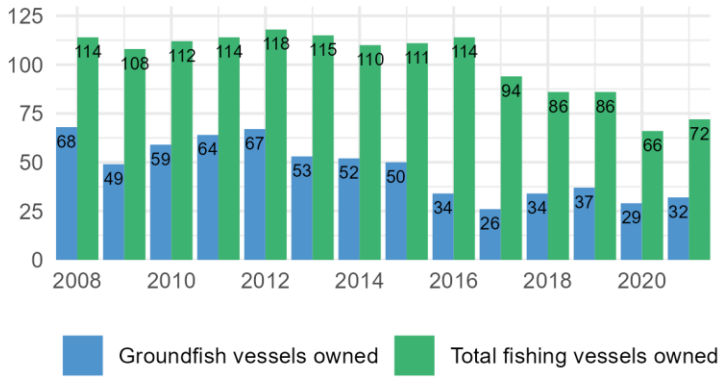
Commercial salmon harvest dominates the area's fisheries; however groundfish harvest accounted for an average of 18% of the total value landed over the past five years for these three communities.. In 2021, groundfish harvests were 26% of the total ex-vessel value landed in these communities, landing 12.2 million whole pounds, with an ex-vessel value of $3.1 million. Compared to 2019, this represents a 23% decline in pounds harvested and 32% in the associated value.

Groundfish Lbs & Ex-vessel Value Harvested by Residents



While the total number of resident owned fishing vessels decreased by 14 in 2021 (down 16% from 2019); this marks an upward trend from 2020 , which saw an all time low of 66. Ownership of groundfish vessels among residents also decreased since 2019, but increased slightly from a dip in 2020. These declines in 2020 are likely due to impacts from the COVID-19 pandemic.

Vessel Ownership Among Residents

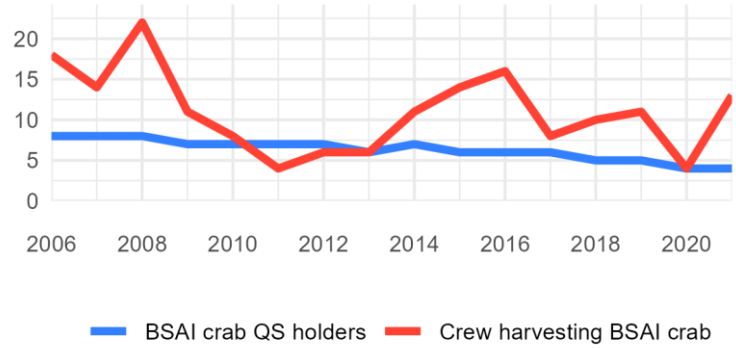


Crab Harvesting Engagement — LOW

In 2021, 780,662 whole pounds of BSAI crab were harvested across Akutan, Sand Point, and King Cove, with an ex-vessel value of $3.1 million.

A number of hired crew resides in these communities and residents continue to own crab licenses and quota shares, although participation has fluctuated. In 2021, there were 13 crew members working in the BSAI crab industry, and just 4 BSAI crab QS holders. This represents a slight increase of 2 crew members since 2019, but 1 fewer QS holder.

Resident Crab Harvesting Crew and QS Holders

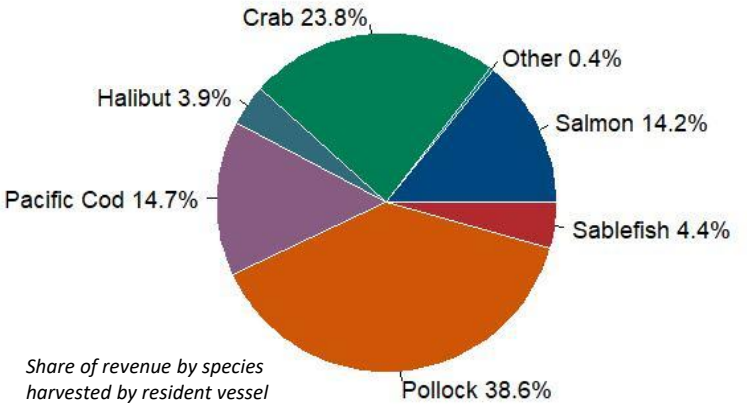


*Includes crew and quota holders in rationalized crab fisheries only

AKUTAN / KING COVE / SAND POINT *(aggregated)*

Share of landing revenue by species

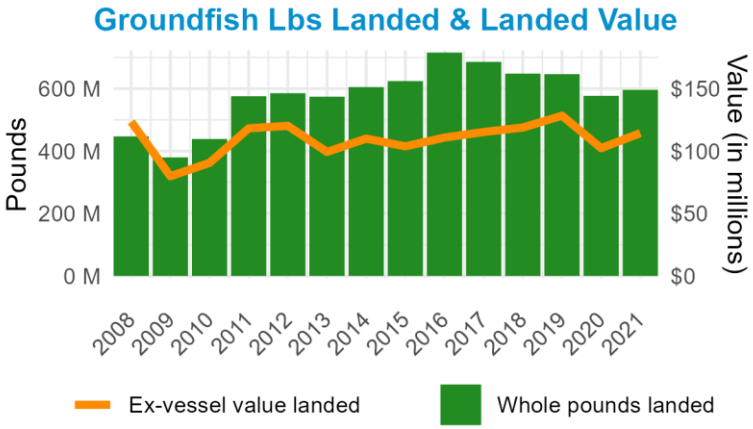
Akutan, King Cove, Sand Point combined 2017-2021 average



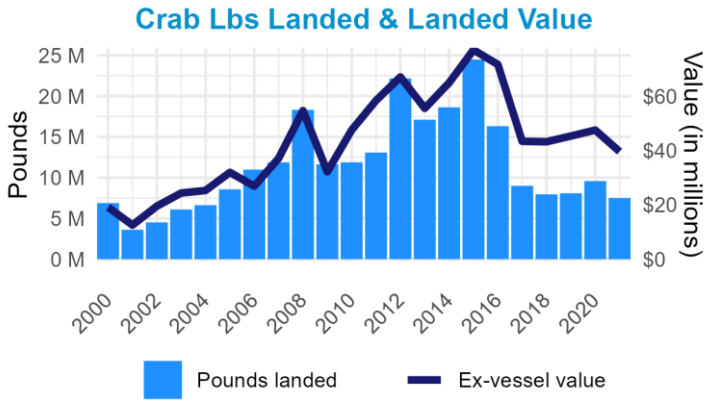
Share of revenue by species harvested by resident vessel owners or permit holders (2017-2021 average). data are aggregated across Akutan, Sand Point, and King Cove due to confidentiality.

GF Processing Engagement — *HIGH*

Over the last five years, Pollock has on average accounted for 38.6% of the landed value within the processing sector in Akutan, King Cove, and Sand Point, while 14.7% is Pacific cod and 14.2% is salmon. The number of processing facilities has decreased by 1 since 2019 to just 5, processing 593 million pounds of groundfish with an ex-vessel value of $114 million in 2021. Compared to 2019, both landings volume and value showed a slight decrease: pounds landed declined 53 million pounds (8%) and associated value declined $13.9 million (10%). In 2021, groundfish fisheries made up 53% of the total value landed in these communities, a slight decline from 2019. The Pacific cod fishery continued to decline, with a 10% dip in pounds processed and a 26% drop in associated value compared to 2019. Pollock fisheries remained relatively steady, but did show a slight decline in both pounds (7%) and landed value (15%) compared to 2019.



Crab Processing Engagement — HIGH



Due to confidentiality concerns, Akutan, King Cove, and Sand Point processing activities are aggregated. These communities are highly engaged in the crab processing sector with seven processing facilities in the region. In 2021, these communities processed 7.5 million net pounds of crab with an associated ex-vessel value of $39 million. Compared to 2019, the volume decreased by 581,437 pounds (down 7%) and the value decreased by $5.7 million (down 12%). The amount of BSAI crab processed in the region reached a peak of 24.5 million pounds in 2015, quickly dropping to 16.3 million pounds the following year (down 33%). Comparatively, the associated value dropped by $5.4 million or 7% during the same year. Both volume and landed value continued a steady decline since.

Community Sketch

KODIAK ISLAND

Demographics (self-identified, Census 2020)

Population	Gender population (%)	Population Over 18 (%)	Median household income ($)	White (%)	American Indian or Alaska Native (%)	Black or African American (%)
12,787	46.2% female 53.8% male	76.1%	$79,173	48%	12.8%	1.4%
Below poverty level (%)	**Housing units**	**Population Over 65 (%)**	**High school graduate or higher (%)**	**Asian (%)**	**Native Hawaiian or Pacific Islander (%)**	**Hispanic or Latino (%)**
7.5%	5,848	13.2%	89.6%	23.6%	0.8%	8.7%

Area Description and History

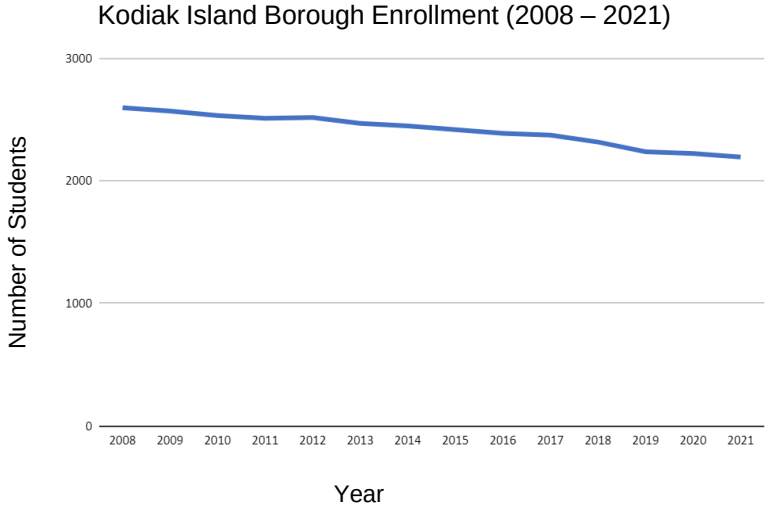
The largest island in the Gulf of Alaska, Kodiak Island is approximately 25 miles across the Shelikof Straight from the Katmai Coast and 90 miles southwest of the Kenai Peninsula. Kodiak Island has been inhabited for the past 8,000 years by the Alutiiq peoples who traditionally harvested fish, marine invertebrates, and marine mammals on the Island. A majority of the Alaska Native population living IN Kodiak today are Alutiiq. Their language is Alutiiq, which is one of the "Esk-Aleut" languages and is closely related to Central Yup'ik.[1] A Russians established a fur trading settlement at Chiniak Bay in the late 1700s. In 1882 a fish cannery opened in Karluk spit, sparking further commercial development. Today, Kodiak communities are highly reliant on both commercial and subsistence fishing harvesting of natural resources, including fishing. The majority of commercial vessels and seafood processing plants are in Kodiak City, which holds Alaska's second largest commercial fishing port in volume of seafood landed. There are two main harbors in Kodiak City: St. Paul Harbor and St. Herman Harbor which is the larger of the two. While the majority of the population of Kodiak Island live in Kodiak City, there are seven other island communities including Akhiok, Port Lions, Larsen Bay, Old Harbor, Karluk and Ouzinkie. Native Associations active in the area include the Natives of Kodiak, Inc., Koniag, Inc., and the Kodiak Area Native Association. Kodiak is located in Federal Statistical and Reporting Area 630, Pacific Halibut Fishery Regulatory Area 3A, and Central Gulf of Alaska Sablefish Regulatory Area.

Infrastructure & Transportation

Kodiak Island is accessible by air and sea, however accessibility varies drastically among communities. Kodiak City has two small airports, which have several daily flights. Air taxi services provide flights to five remote villages; however weather conditions often restrict travel. City-owned seaplane bases at Trident Basin and Lilly Lake accommodate floatplane traffic. The state ferry operates three to four times a week between Kodiak and Homer, and in the summer months, includes other ports as far west as Dutch Harbor. The Port of Kodiak has two boat harbors with 600 boat slips. Three deep-draft piers accommodate ferries, cruise ships, container ships, military vessels, and a variety of large commercial fishing vessels. Approximately 140 miles of state roads connect island communities on the east side of the island. However, island communities have limited access to medical services and residents must travel to Kodiak City or Anchorage for treatment.

Stable school enrollment is a concern for Kodiak communities, which have struggled to keep schools open with declining enrollment. Total K-12 school enrollment has decreased by 15.5% since 2008. Larsen Bay School closed in 2018, and Karluk school closed in 2019 due to low enrollment.

While Kodiak Island is highly engaged in commercial fishing, many residents in the smaller island communities have trouble accessing necessary services, such as medical services or schools. These aspects also have consequences for community adaptive capacity, discussed in the following section.



Climate Change Vulnerability and Adaptive Capacity

Exposure to Biophysical Effects of Climate Change

A community's exposure to the biophysical effects of climate change, which include effects to the biological organisms and physical landscape surrounding them, aids in determining their vulnerability. Biophysical risks to the Gulf of Alaska as a whole include sea level rise, coastal erosion, changes in precipitation, and increased storm severity.[1] The specific community risk levels are listed to the right. Overall, the Island has a **medium risk of exposure to the biophysical effects** of climate change because of their location in the Gulf of Alaska. Specific climate resiliency or action plans have not yet been drafted by the communities on Kodiak Island.

Dependence on Fisheries Impacted by Climate Change

Kodiak Island is overall **highly dependent on fisheries resources** which will be impacted by climate change. Residents are highly engaged in harvesting and processing within the groundfish fishery, and moderately engaged in harvesting and highly engaged in processing within the crab fishery. Ocean acidification and species migrations which are affecting the Gulf of Alaska will likely impact the ability of commercial fishers on the Island to operate as they have been.[1] In addition, the island is highly reliant on recreational fishing and tourism related to recreational fishing for their current economy.

Kodiak Island communities are also significantly engaged in subsistence fishing, particularly of crab species and certain groundfish species. They also harvest salmon and halibut for subsistence purposes. Their combined use of several fisheries for subsistence makes them reliant on these resources which likely support household food security, particularly in smaller communities where pounds harvested per capita are high. Finally, there are several subsistence and sport salmon fishing closures active around Kodiak Island including one that spans the marine waters near the outlet of the Buskin River and one in the marine waters of Afognak Bay.[2] These closures are likely to impact the highly fishing-reliant population of Kodiak Island. Residents were also impacted by the 2022 closure of both the Snow crab fishery and the Bristol Bay Red King crab fisheries [3, 4] due to concerns over population levels which have struggled due to warming oceans.[5]

Local Adaptive Capacity

Overall across communities, Kodiak Island has **medium limitations on its adaptive capacity**. It also has a very low ability to adapt to changing conditions, according to FEMA's National Risk Index.[6] This rating takes into account factors of the community which can make it harder to adapt when disruptions occur, such as: poverty levels, age of the population, unemployment rates, English language proficiency, and education level.

With medium rates of poverty and a population composition which contains many high risk individuals, Kodiak Island faces obstacles to adaptation. This is important to consider when shaping management strategies for the fisheries Kodiak Island residents are most engaged in. Drastic shifts in policy or ones that do not account for the ability of residents to adapt to changing fishery conditions could hinder the community's ability to stay highly engaged in a particular fishery.

*Social Indicators for Fishing Communities**

Low

Labor Force: Med.

Housing Characteristics: Med.

Poverty: High

Population Composition: Low

Personal Disruption:

*Climate Change Vulnerability Ratings***

Med.

Exposure to Biophysical Effects: High

Akhiok: Med
Karluk: Low
Kodiak: Low
Larsen Bay: Med
Old Harbor: Med
Ouzinkie: Med
Port Lions: Med

Fisheries Resources Dependence: Med.

Akhiok: High
Karluk: Med
Kodiak: High
Larsen Bay: High
Old Harbor: High
Ouzinkie: High
Port Lions: High

Limitations on Adaptive Capacity:

Akhiok: High
Karluk: Med
Kodiak: Med
Larsen Bay: Med
Old Harbor: Med
Ouzinkie: Med
Port Lions: Low

*Source: NOAA Fisheries Office of Science and Technology. 2019. NOAA Fisheries Community Social Vulnerability Indicators (CSVIs). Version 3 (Last updated December 21, 2020). https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities-0

**Source: Himes-Cornell, A., & Kasperski, S. (2015). Assessing climate change vulnerability in Alaska's fishing communities. Fisheries Research, 162, 1–11. https://doi.org/10.1016/j.fishres.2014.09.010

Subsistence Harvesting Engagement

Subsistence hunting and fishing are an important part of people's recreation and livelihoods on Kodiak Island. All communities there are significantly reliant on groundfish and crab fisheries for subsistence purposes, with 18%-75% of households using at least one species of groundfish, and 15-90% of households using at least one species of crab. The most popular species across all communities are species of crab followed by cod, rockfish, lingcod, and sablefish.

While data on subsistence fishing from these communities were collected during different years ranging from 1991 through 2018, and therefore cannot be compared, the data offer glimpses into potential trends across and within each community. For instance, in 2018 the community of Akhiok was particularly reliant on crab resources with 90% of households using this resource and 73% receiving it from others. Similarly, in 2003, 75% of households in Ouzinkie used a variety of groundfish species including cod, 37% used lingcod, and 59% used rockfish. In 2018, residents of Akhiok harvested 7.86 pounds of crab per capita, and in 2003, the community of Port Lions harvested 7.4 pounds of cod per capita. Overall, the community of Karluk, with data from 1991, had the lowest use rates compared to other communities in different years.[1]

Kodiak Island communities also participate in salmon and halibut subsistence harvests. Trends across all communities from 2015-2019 indicate that harvests of salmon have decreased in recent years, while harvests of halibut have remained the same or increased since 2012. These are important trends which suggest a potential shift in availability of these resources in this area.[1,2]

Groundfish Subsistence
Kodiak City (1993)*

38.1%
Households using at least one species**

21.9%
Households receiving at least one species**

65,385
Total pounds harvested

10.8
Pounds per capita harvested

****Species include Cod, Sablefish, Lingcod, and Rockfish**

Crab Subsistence
Kodiak City (1993)*

76.2%
Households using at least one species**

68.6%
Households receiving at least one species**

30,757
Total pounds harvested

5.08
Pounds per capita harvested

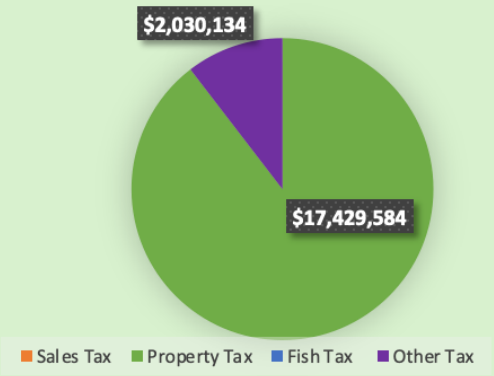
****Species include Dungeness, Red King and Tanner Crab**

* All subsistence information is from the Community Subsistence Information System (CSIS), ADFG. The CSIS is a repository of Alaska community harvest information gathered on the household level by ADFG, Division of Subsistence. This reflects the most recent data available. While some data are well in the past, they still reflect important information on subsistence activities within the community. These data will be updated as is available.

Current Economy

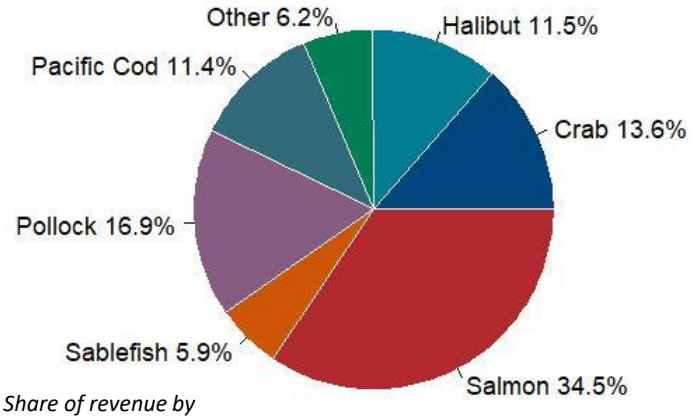
Commercial fishing, seafood processing, and commercial fishing support services are the major industries contributing to the local economy. The U.S. Coast Guard station and hospital are also significant employers. Other industries include retail services and government. Tourism is growing, and recreational fishing, hiking, and kayaking are increasing in popularity. Kodiak's economy is reliant on fishing, logging, ecotourism, and sport hunting/fishing (3). In 2021, Kodiak City did not report values for fish-related taxes .(both municipal and shared), making fish tax data unavailable. Data related to port/dock usage fees are also not available (2). Since these fees and taxes account for a significant portion of fisheries-related revenue in previous years, it is likely that revenue figures are underrepresented. These revenues support basic city services such as education, sanitation, transportation, etc. and are important indicators of community health and wellbeing. Poverty levels, per capita income, and median household income have remained relatively constant since 2018, which is an indicator of community stability despite disruptions such as the COVID-19 pandemic. .

Kodiak Island 2021 Municipal Tax Revenue



Share of Revenue Harvested by Species

Kodiak Island 2017-2021 average

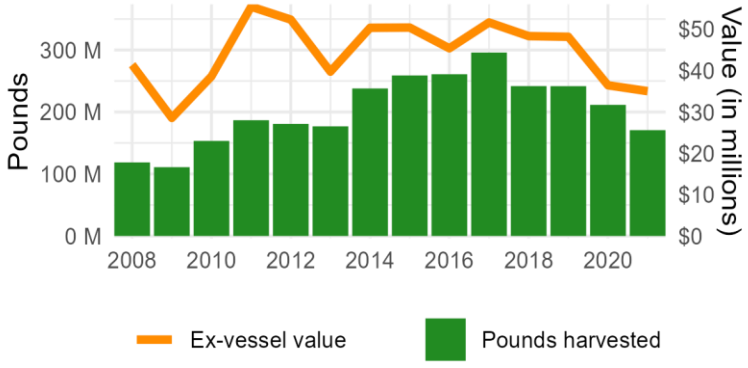


Share of revenue by species harvested by resident vessel owners or permit holders (2017-2021 average)

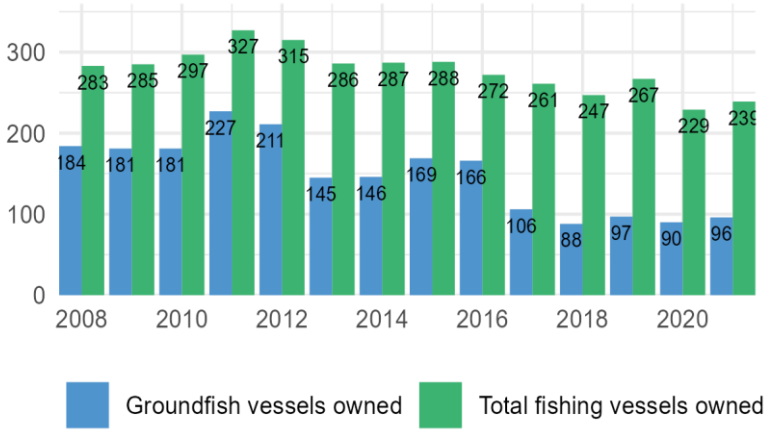
GF Harvesting Engagement — HIGH

Kodiak Island has a diversified fisheries profile, with groundfish making up about 39% of total fisheries harvest. Pacific cod has continued its recent decline in pounds landed by residents, with a five-year low of 23 million pounds in 2020. In 2021, the volume of groundfish harvest was 170.7 million pounds with an associated ex-vessel value of $35 million. Compared to 2019, both the harvest volume and associated value showed declines of 70 million pounds (down 29%) and $13.1 million (down 27%) respectively. Resident ownership of fishing vessels decreased by 28 vessels (9%) in 2021 from 2019, while groundfish fishing vessels owned by Kodiak Island residents decreased by 1. Both measures rebounded slightly after larger dips in 2020, potentially due to the COVID-19 pandemic. Smaller communities on Kodiak Island are often most severely impacted by shifts in fisheries participation given that the bulk of commercial fisheries operations occur in Kodiak City.

Groundfish Lbs & Ex-vessel Value Harvested by Residents

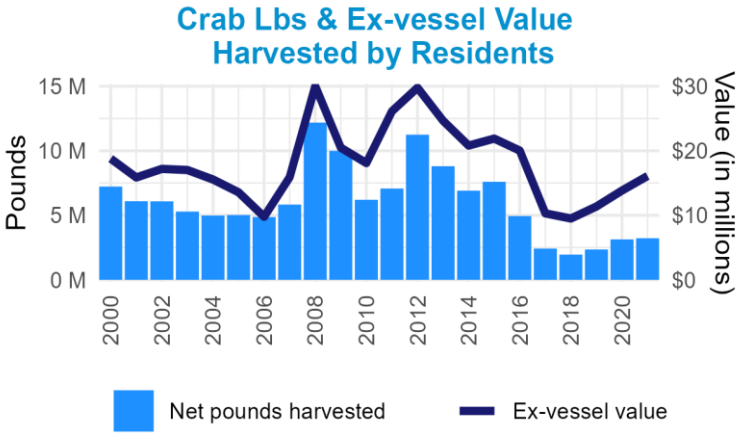


Vessel Ownership Among Residents



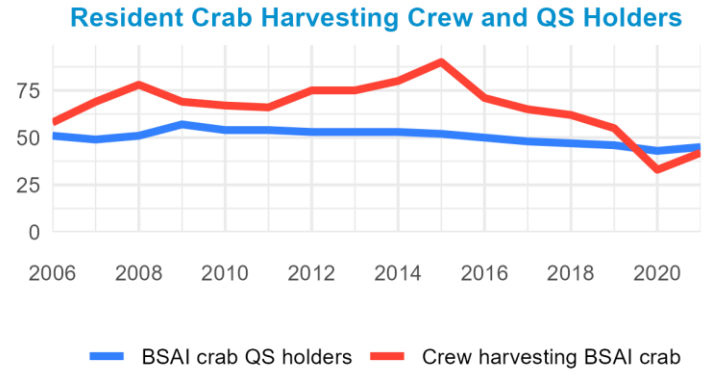
Crab Harvesting Engagement — *MED-HIGH*

Kodiak Island's resident vessels harvesting BSAI crab fisheries have seen drastic declines since 2012. However, both harvest volume and ex-vessel value have increased slightly each year since 2018. In 2021, fishers harvested 3.2 million pounds of crab with an ex-vessel value of $16 million which, compared to 2018, showed a 1.2 million pounds (65%) increase in volume and $6.5 million (69%) increase in value.



Within the BSAI crab fisheries, the number of crew living in Kodiak Island communities declined from 55 in 2019 to 42 in 2021 (24%), despite a slight rebound from a 2020 low of 33. Having hit a peak in 2015 of 90 resident crew members, the number fell by 21% in 2016, and continues to decline.

As of 2021, there were 45 quota share holders residing in Kodiak Island communities. This number has remained relatively constant over the past five years although there is a general downward trend since 2009, which had a high of 57 quota share holders.



*Includes crew and quota holders in rationalized crab fisheries only

GF Processing Engagement — *HIGH*

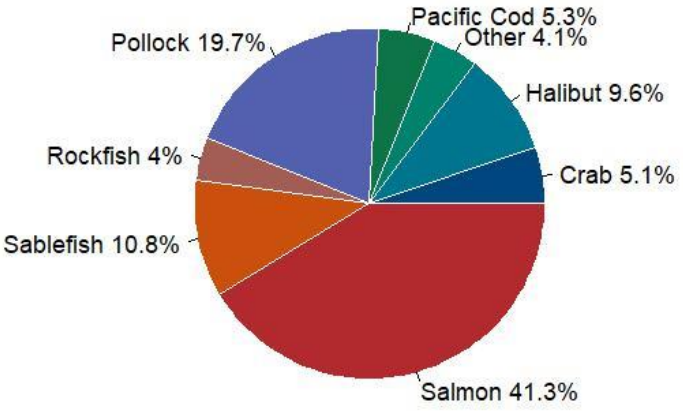
Overall, Kodiak facilities processed 231 million whole pounds of groundfish worth $44.8 million in 2021. When compared to 2019, the volume of groundfish landings fell by 46.7 million pounds (16%) and $9.8 million in associated value (down 17%).

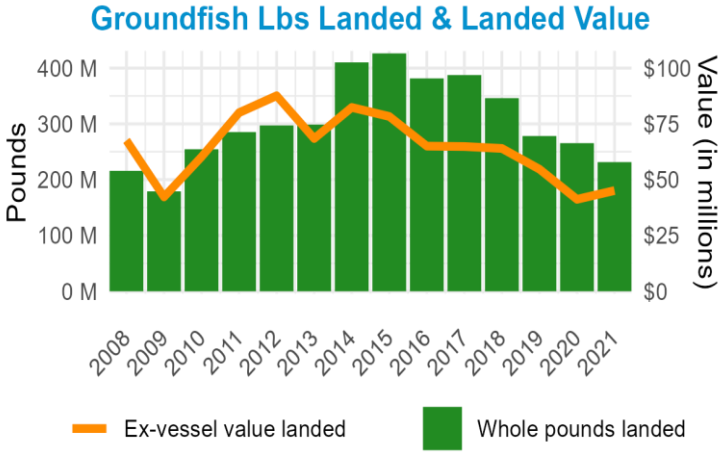
Kodiak Island has several multi species processors in Kodiak City. Over the past five years, groundfish made up an average of 48% of the total ex-vessel value of all species landed. In 2021, groundfish processing accounted for 68% of total fish landed. Although the bulk of processing occurs in Kodiak City, smaller Kodiak communities are involved in seafood processing as well. Pollock holds the majority share of revenue landed in Kodiak Island Borough in 2021 at 48%, followed by salmon at 25%.

Share of landing revenue by species for Kodiak

combined 2017-2021 average

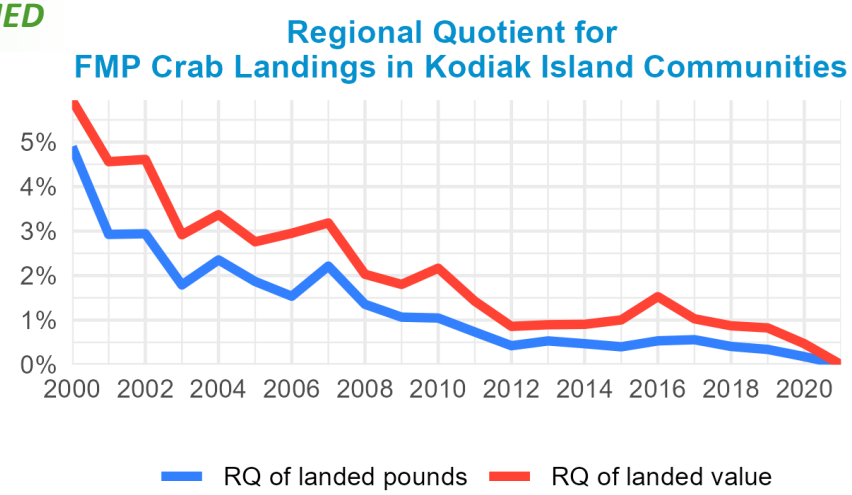
Share of revenue landed in community by species (2017-2021 average)



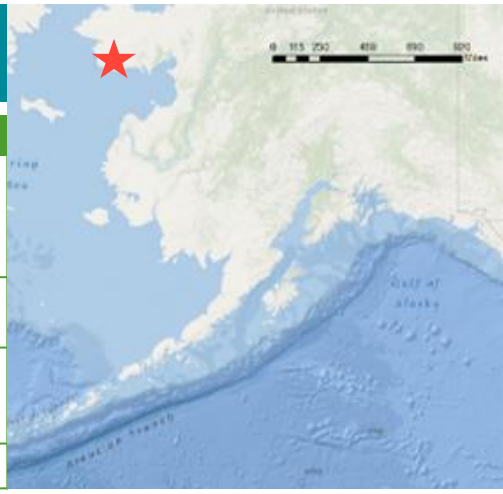


Crab Processing Engagement *MED*

Due to confidentiality concerns, some processing data are restricted and therefore can only be shown as general trends. In order to show the general processing trends for crab FMP, the processing regional quotient (RQ) is presented here. The RQ for pounds and revenue landed in Kodiak show a steady decline over the past two decades, indicating a decrease in participating in the crab processing sector.



Community Sketch NOME



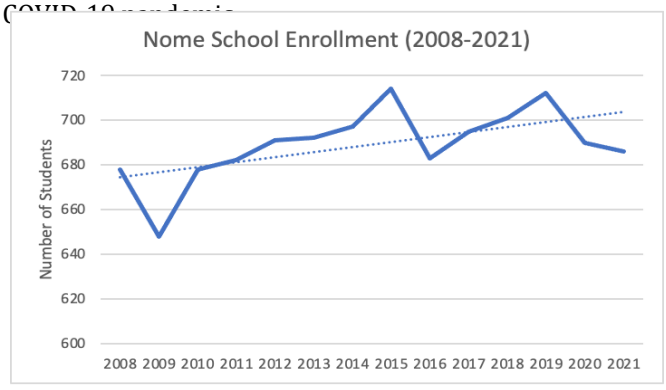
Demographics (self-identified, Census 2020)						
Population	**Gender population (%)**	**uPopulation Over 18 (%)**	**Median household income ($)**	**White (%)**	**American Indian or Alaska Native (%)**	**Black or African American (%)**
9,865	47.3% female 52.7% male	66.0%	$62,843	14.7%	75.9%	0.8%
Below poverty level (%)	**Housing units**	**Population Over 65 (%)**	**High school graduate or higher (%)**	**Asian (%)**	**Native Hawaiian or Pacific Islander (%)**	**Hispanic or Latino (%)**
18.8%	4,102	8.7%	86.0%	1.6%	0.2%	2.2%

Area Description and History

Nome is located on the south coast of the Seward Peninsula. Historically, Malemiut, Kauweramiut, and Unalikmiut Iñupiat have occupied the area for thousands of years. Nome was a supply center for Russian whaling and trading in the mid 1800s; its population exploded during the Nome gold rush in 1898. The City of Nome was incorporated in 1901. Commercial exploitation of halibut and groundfish first extended into the Bering Sea region in 1928. King crab fisheries began in the 1950s, and Norton Sound is one of the fisheries historical centers. Nome is located in Pacific Halibut Fishery Regulatory Area 4E and the Bering Sea Sablefish Regulatory Area. Nome serves as a regional center of supply, services, and transportation in the Norton Sound and Bering Strait region, and many government offices are located there. Nome was included under the Alaska Native Claims Settlement Act (ANCSA) and is federally recognized as a Native village. Four federally-recognized Tribes are located within the City of Nome: the Nome Eskimo Community, Solomon Tribal Council, King Island Native Community, and the Council Traditional Council. Two Native Corporations are active in the area, including Bering Straits Native Corporation and Sitnasuak Native Corporation.

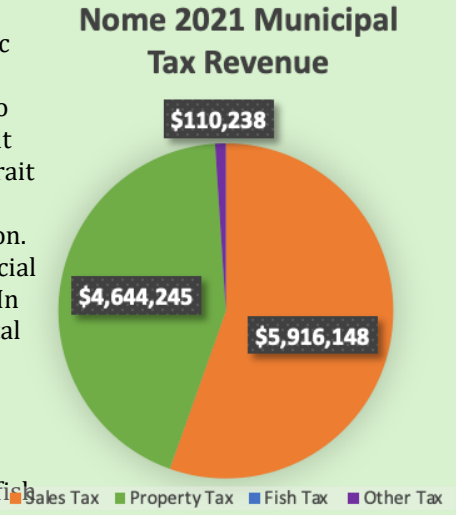
Infrastructure & Transportation

Nome is accessible by air and sea with two state operated airports, and two health facilities: Nome Health Center and the Norton Sound Regional Hospital, both operated by the Norton Sound Health Corporation. The hospital is a qualified Acute Care facility and offers Medevac Service. Additional facilities include: state and local government, US Coast Guard facilities, Northwest Campus-UA, Fairbanks, the Katirvik Cultural Center, public library, and maritime support services. As the Arctic gateway, Nome plans to develop a deep water port that has substantial implications for Nome and the broader nation, including national security, emergency preparedness, and employment. Nome has three schools; enrollment has remained fairly stable over the past decade, with a 3% decrease in school enrollment between 2019 and 2020,[1] likely due to the COVID-19 pandemic.



Current Economy

Nome's economy is based on public administration, fishing and other public sector jobs. Nome is home to Kawerak, Inc., the Native non-profit organization serving the Bering Strait region and the Norton Sound Economic Development Corporation. Many residents engage in commercial fishing, and subsistence activities. In 2021, Nome reported $1,977 in total fishery related taxes (including shared and municipal), with the $5,916,148 sales tax value likely encompassing some of these fish taxes.[2] The same $1,977 fish total fish tax value was recorded in 2019.[2]



These revenues support basic city services such as education, sanitation, transportation. In 2020, per capita income in Nome was estimated to be $37,699 (up 16% since 2018), and the median household income $62,843 (down 26% since 2018).[3] The percentage of the population living below the poverty line increased by 13% since 2018.[3] These measures are important for understanding the current economic well-being of residents and indicate potential changes in economic security. Additionally, these factors contribute to the community's ability to adapt to stressors such as food security, storm events, and climate change. We address the issue of climate change in the following section.

Climate Change Vulnerability and Adaptive Capacity

Exposure to Biophysical Effects of Climate Change

A community's exposure to the biophysical effects of climate change, which include effects to the biological organisms and physical landscape surrounding them, aids in determining their vulnerability. Observed climate change impacts in the city of Nome include warmer temperatures, increased storminess, changes in sea ice, less snow and more rain in the winter, rainier summers, shallower creeks, and permafrost thaw. These changes pose several risks relating to public health and safety, subsistence, infrastructure, and have led to increased shipping in the area.[4] Due to the remoteness of this community and its vulnerable location, it has a relatively **high risk of exposure to the biophysical effects of climate change**. This was further evidenced by the effects of Typhoon Merbok on Nome in September 2022, which caused near-record high water levels and extreme flooding.[5]

Dependence on Fisheries Impacted by Climate Change

Reliance on fisheries resources which are being impacted by climate change can determine how vulnerable a community is to disruption from climate change. Overall, the city of Nome is moderately engaged in harvesting within the crab fishery, but highly engaged in processing. In addition, while recreational fishing is not as important to the economy or lifestyle of residents, this is offset by its particularly high reliance on subsistence fishing. The majority of the Alaska Native population in Nome depends heavily on local wild food resources as important nutritional sources in their diets, particularly salmon, tomcod, crab, and seal. In addition, the subsistence way of life plays an integral role in the cultural and traditional values of tribal members living in the Nome area.[4] They rely heavily on salmon in particular for subsistence purposes. Their ability to harvest and preserve salmon and other subsistence species has also been negatively impacted by changes in the climate in recent years, particularly warming trends which often make it harder to preserve salmon, changes in sea ice, which may make it harder to access subsistence harvesting areas.[4] Considering all three of these measures, Nome overall is **moderately dependent on fisheries resources** which will be impacted by climate change**.**

*Social Indicators for Fishing Communities**

Labor Force:	Low
Housing Characteristics:	Med.
Poverty:	Low
Population Composition:	Med-High
Personal Disruption:	Med.

*Climate Change Vulnerability Ratings***

Exposure to Biophysical Effects:	High
Fisheries Resource Dependence:	Med.
Limitations on Adaptive Capacity:	Med.

*Source: NOAA Fisheries Office of Science and Technology. 2019. NOAA Fisheries Community Social Vulnerability Indicators (CSVIs). Version 3 (Last updated December 21, 2020). https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities-0

**Source: Himes-Cornell, A., & Kasperski, S. (2015). Assessing climate change vulnerability in Alaska's fishing communities. Fisheries Research, 162, 1–11. https://doi.org/10.1016/j.fishres.2014.09.010

It is predicted that the social and cultural lives of Nome residents will be impacted by the effects o f climate change in moderate ways. One recent example is the dramatic decline of BSAI snow crab fisheries and resulting closures. Recently, federal and state fisheries closures have affected Nome residents: in 2020, both the summer and winter Norton Sound Red King Crab (RKC) fisheries were closed due to low stock. In 2021, the Norton Sound Seafood Products ceased purchasing Norton Sound RKC in an effort to bolster the stock..[6] In 2022, subsistence salmon fishing was closed in the southern Norton Sound.[7]

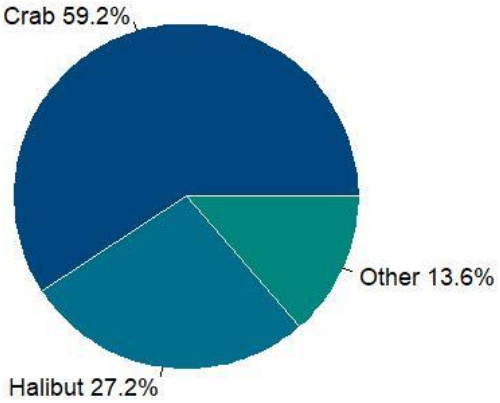
Local Adaptive Capacity

Nome has **moderate limitations on its adaptive capacity**. This rating takes into account factors in the community which can make it harder to adapt when disruptions occur. Nome received a moderate rating due to their population composition, which is comprised of individuals with medium to higher levels of vulnerability, the moderate level of residents' personal disruption. In addition, according to the National Risk Index, Nome has a very high susceptibility to the adverse impacts of natural hazards and a very low ability to prepare for or adapt to changing conditions.[8] This is important to consider when designing management policies for the fisheries resources this community depends on because drastic shifts may hinder their ability to stay highly engaged in a particular fishery.

Share of harvest revenue by species

Nome 2017-2021 average

Share of revenue by species harvested by resident vessel owners or permit holders (2017-2021 average)

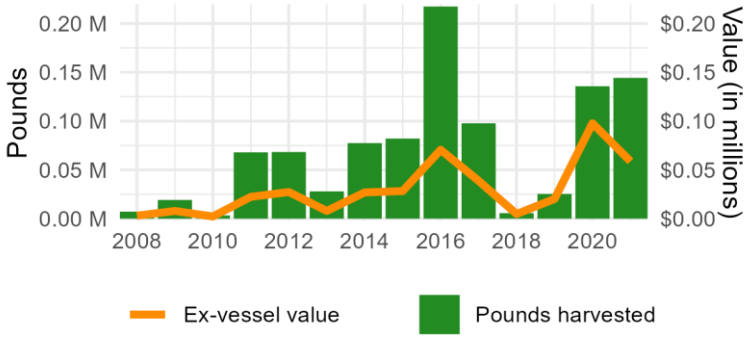


GF Harvesting Engagement — LOW

Among commercial fisheries in Nome, groundfish engagement has been low and primarily targeting Pacific cod. However, starting in 2020 and continuing In 2021, Pacific cod accounted for a much higher percentage of pounds harvested (74%) and harvest revenue (34%) than in previous years. During the same time period, both pounds harvested and harvest revenue fell significantly for crab and halibut. This was likely a consequence of the Red King Crab fishery closure in 2020.

Today, Nome king crab fishermen hold both state-issued king crab permits, as well as permits in the Community Development Quota fishery. Norton Sound Seafood Products was established in 1995 and processes red king crab, salmon, and halibut.

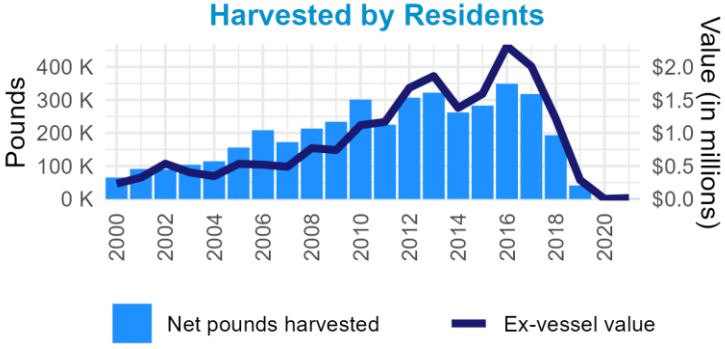
Groundfish Lbs & Ex-vessel Value Harvested by Residents



Crab Harvesting Engagement — MED-HIGH

Alaska FMP crab fisheries have struggled in recent years: hitting a peak in 2016 in both harvested volume and associated ex-vessel value, then beginning a steep decline. Bering Sea snow crab, Bristol Bay and Norton Sound Red King Crab have faced closures, late starts to the season, and reduced catch limits in recent years. This has affected Nome's engagement in these fisheries. In 2021, crab vessels registered in Nome harvested just 684 pounds of BSAI crab, a 98% decrease from 2019. The associated ex-vessel value in 2019 was $286,858, then down to $15,267 in 2021 (down 95%). Communities highly engaged in FMP crab fisheries, such as Nome, have undergone substantial economic and social challenges as a result of these declines including loss of income, reduced opportunities, high levels of uncertainty, personal disruption, and increased food insecurity.

Crab Lbs & Ex-vessel Value Harvested by Residents

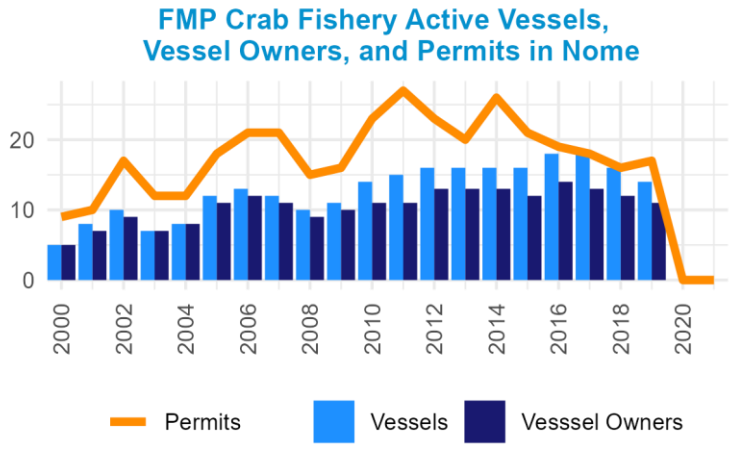


*Includes harvest by resident vessel owners and permit owners

Due to confidentiality concerns, only select data are available.

In 2020, both the summer and winter Norton Sound red king crab (RKC) fisheries were closed due to low stock. To support rebuilding the stock, the Norton Sound Economic Development Corporation ceased purchasing RKC. This is reflected in the data which shows crab harvests and ex-vessel value decreased to zero in 2020, as well as lack of vessels and permits. Given simultaneous increases in harvests of Pacific cod during these two years, it is possible Nome fishermen attempted to compensate for the crab declines by engaging more in the groundfish fishery. Additional social science research with commercial fishing fleets could illuminate decision-making processes under such stressors.

FMP Crab Fishery Active Vessels, Vessel Owners, and Permits in Nome



Subsistence Harvesting Engagement

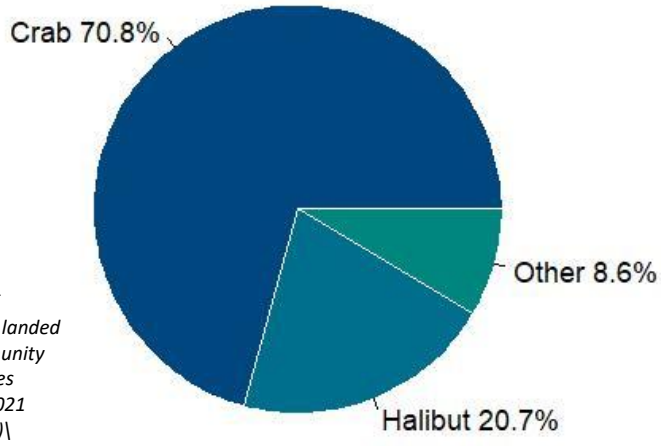
The majority of the Alaska Native population in Nome depends heavily on local wild food resources such as salmon, tomcod, crab, and seal as important nutritional sources in their diets. The subsistence way of life plays an integral role in the cultural and traditional values of tribal members living in the Nome area.[4] While groundfish and crab subsistence harvesting data were not available for Nome through CSIS as they were for other communities, Nome residents' extensive use of other resources, particularly salmon, indicate that they likely rely on these fisheries as well. It also highlights the severe need for subsistence harvesting data for this community so we can better understand to what extent they engage with and rely on subsistence fishing of different species.

According to Alaska Dept. of Fish and Game data, while subsistence harvests of halibut have fluctuated since 2012, subsistence harvests of salmon have remained relatively constant and at a high level.[10, 11] Declines in salmon stocks have also been found to affect Nome residents, who have often turned to less regulated areas to subsistence fish when severe salmon fishing restrictions have been instituted.[9] The importance of this species in particular to their culture and livelihood cannot be overstated. Finally, recent data from the Norton Sound overall show that from 2016-2020 there was an average of 2,873 pounds of red king crab caught for subsistence during the summer season and 8,844 pounds in the winter season. The summer saw an average of 40 subsistence harvesting permits issued, and the winter 121. These numbers decreased in 2021 to just 1,723 pounds harvested in the summer and 6,941 pounds in the winter. Winter permits also decreased to just 103, but summer permits increased to 42.[12]

Photos: Subsistence harvests of Norton Sound Red King Crab.
Photo credit: Kelsi Ivanoff

Share of landing revenue by species for Nome

combined 2017-2021 average



Share of revenue landed in community by species (2017-2021 average)

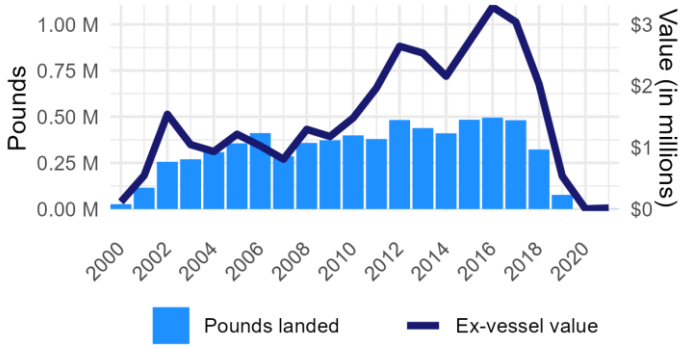
GF Processing Engagement — *LOW*

In 2021, significantly more pounds of Pacific cod were landed than in previous years (an increase of 584% since 2019). There was also a corresponding 230% increase in landed value. However, over the last five years, groundfish processing engagement has remained low on average. It remains to be seen whether these higher engagement levels will persist in the future.

Crab Processing Engagement — *MED-HIGH*

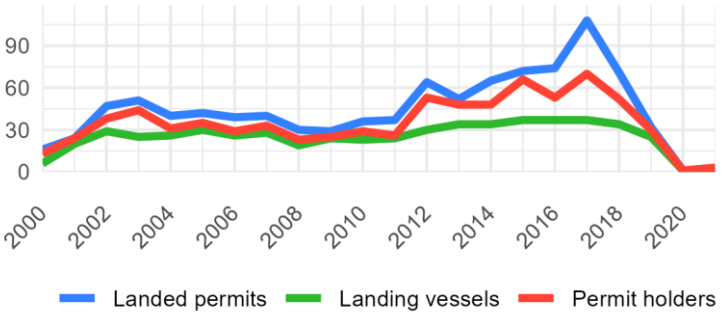
Nome is highly engaged in the crab processing sector. The number of crab buyers in the region has fluctuated over the years, but dropped from 8 to 3 in 2019 and remains at that number in 2021. Nome did not process significant amounts of crab in 2020 or 2021 due to the closure of the red king crab fishery. In 2019, the most recent year for which processing data are available before the closure, Nome processed 76.5 thousand net pounds of crab with an associated value of $534.6 million.

Crab Lbs Landed & Landed Value



The amount of BSAI crab processed in the region reached a peak of 494,871 net pounds (with a value of $3.3 million) in 2016 and has been declining steeply since. The number of permits ;landed continues to fall as well: in 2019, there were 30 crab permit holders with landings in Nome, a drop from 52 in 2018. There were no permits or permit holders with landings in 2020 or 2021 due to the closure of the fishery.

BSAI Crab Landing Permits, Permitholders, and Vessels



*Permits counted are CFEC gear operator permits

Community Sketch PETERSBURG

Demographics (self-identified, Census 2020)

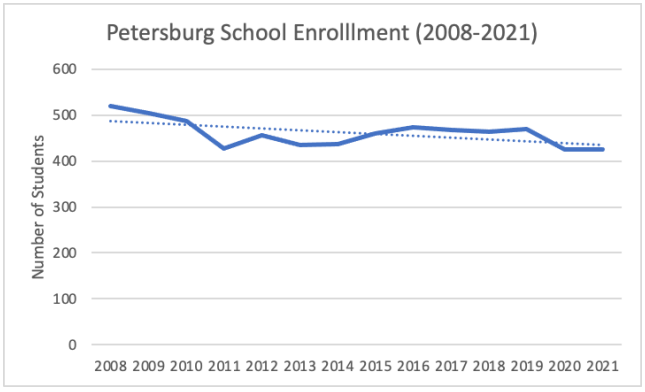
Population	Gender pop. (%)	Pop. Over 18 (%)	Median household income ($)	White	Am. Indian/AK. Native	Black or African Am.
3,356	48.3% female 51.7% male	78.5%	$68,667	73.7%	10.6%	1.9%
Below poverty level (%)	**Housing units**	**Pop. Over 65 (%)**	**High school graduate or higher (%)**	**Asian**	**Native HI./Pacific Islander**	**Hispanic or Latino**
7.4%	1,748	21.4%	89.2%	5.2%	0.8%	5.5%

Area Description and History

Historically utilized by Tlingits as a fish camp, Petersburg is located on the northwest end of Mitkof Island. In the 1800s, Norwegian immigrants settled in the area and built a cannery, sawmill, and dock by 1900. Alaska's first shrimp processor, Alaska Glacier Seafoods, was founded in 1916. In 2013 the City and Borough of Petersburg was incorporated. [1] The community maintains a mixture of Tlingit and Scandinavian history. It is known as "Little Norway" for its history and annual Little Norway Festival during May. As in many Alaskan communities, subsistence harvest, particularly of Salmon, halibut, shrimp, and crab, is important. Petersburg has participated in commercial fisheries since the late 1800s. Commercial harvest of salmon began in the late 1870s and soon after, a commercial fishery began for halibut, with sablefish targeted as a secondary fishery. Although salmon continues to be vitally important fisheries , Petersburg has a diversified fleet that participates across numerous State and Federal fisheries. Management of the Southeast Alaska lingcod fishery includes a winter closure for all users, except longliners, to protect nest-guarding males.[1] The number of Petersburg City residents living in group quarters is approximately 46,[2] although this is not directly associated with fisheries. Petersburg is located in Pacific Halibut Fishery Regulatory Area 2C and Federal Statistical and Reporting Area 659. Petersburg is in House District 35, Senate District R. Native Associations and Corporations active there today include the Petersburg Indian Association.

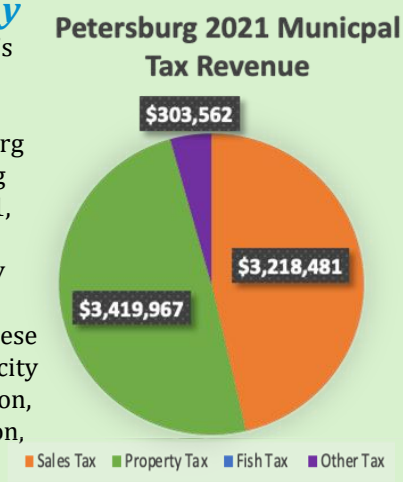
Infrastructure & Transportation

Petersburg is accessible by air and water. The community is serviced twice daily by Alaska Airlines with flights to Juneau and Seattle as well as charter services, and seaplanes. The Alaska Marine Highway provides regular ferry service. Petersburg is on the mainline route which connects Bellingham to Southeast Alaska. The ferry operates five times a week. Harbor facilities include a petroleum wharf, barge terminals, three harbors with moorage for 700 boats, a launch, and haul-out. There is no deep-water dock for large ships such as cruise ships. Water in Petersburg is sourced from a 200-million gallon water reservoir. There are three schools; overall student enrollment has decreased by 18% in this district since 2008. Enrollment decreased by 9% between 2019 and 2020, which likely occurred due to the COVID pandemic.[3]



Current Economy

Historically, Petersburg's economy was based on commercial fishing and timber. Today, Petersburg is one of the top-ranking ports in the U.S. In 2021, Petersburg collected $855,021 in total fishery related taxes, a 14% increase from 2019.[4] These revenues support basic city services such as education, sanitation, transportation, and other services.



In 2020, per capita income in Petersburg was estimated at $34,009 (up 2% since 2018), [2] and the median household income $68,667 up 8% since 2018).[2] The percentage of the population living below the poverty line has decreased slightly (0.4%) since 2018.[2] These measures are important for understanding the current economic wellbeing of residents and indicate potential social and economic changes. Additionally, these factors contribute to the community's ability to adapt to stressors such as food security and climate change.

Climate Change Vulnerability and Adaptive Capacity

Exposure to Biophysical Effects of Climate Change

A community's exposure to the biophysical effects of climate change, which include effects to the biological organisms and physical landscape surrounding them, can determine their vulnerability. Similar to other areas of Alaska, southeast Alaska is already experiencing increasing temperatures and changes in precipitation patterns, including receiving less snow and more rain. Changes have also been observed in forest habitats, including declines of yellow cedar trees, and marine habitats, including ocean acidification and increased prevalence of invasive species. These impacts are currently and will continue to impact human health in various ways.[5] However, in comparison to other Alaskan communities who are more vulnerable to erosion, melting sea ice, and permafrost loss, Petersburg is at a **low risk of exposure to the biophysical effects of climate change.**

Dependence on Fisheries Impacted by Climate Change

Reliance on fisheries resources, impacted by climate change, influence how vulnerable a community is to climate driven disruption. Petersburg is highly engaged in harvesting and moderately to highly engaged in processing in the groundfish fishery. Tourism for recreational fishing is also a substantial part of the local economy. The community is also highly engaged in subsistence fishing, particularly for salmon and crab species, but also for certain species of groundfish including rockfish, sablefish and cod.

Given this, Petersburg is overall **highly dependent on fisheries resources** that will be impacted by climate change**.** Therefore, as this community is impacted by a changing marine environment, their ability to fish for commercial, recreational, and subsistence purposes will be affected. Residents are highly concerned about impacts to several key species, including salmon, shellfish, eulachon, herring and halibut.[5]

*Social Indicators for Fishing Communities**

Labor Force:	Low
Housing Characteristics:	Med.
Poverty:	Low
Population Composition:	Med.
Personal Disruption:	Low

*Climate Change Vulnerability Ratings***

Exposure to Biophysical Risks:	Low
Fisheries Resource Dependence	High
Limitations on Adaptive Capacity:	Med.

*Source: NOAA Fisheries Office of Science and Technology. 2019. NOAA Fisheries Community Social Vulnerability Indicators (CSVIs). Version 3 (Last updated December 21, 2020). https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities-0

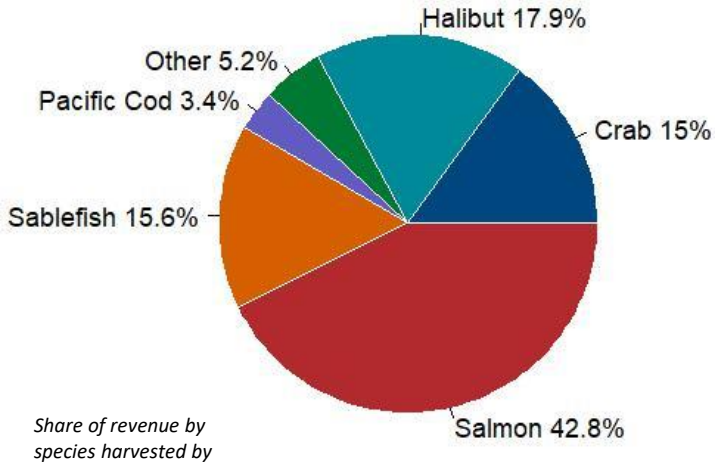
**Source: Himes-Cornell, A., & Kasperski, S. (2015). Assessing climate change vulnerability in Alaska's fishing communities. Fisheries Research, 162, 1–11. https://doi.org/10.1016/j.fishres.2014.09.010

Local Adaptive Capacity

Petersburg has **medium limitations on its adaptive capacity**. This rating takes into account factors in the community which can make it harder to adapt when disruptions occur. Petersburg received a medium rating due to moderate vulnerability of its housing and infrastructure, a population which is moderately comprised on higher risk individuals. FEMA's National Risk Index also rates Petersburg as having very low community resilience,[6] meaning they have a very low ability to adapt to changing conditions and withstand and recover rapidly from disruptions.

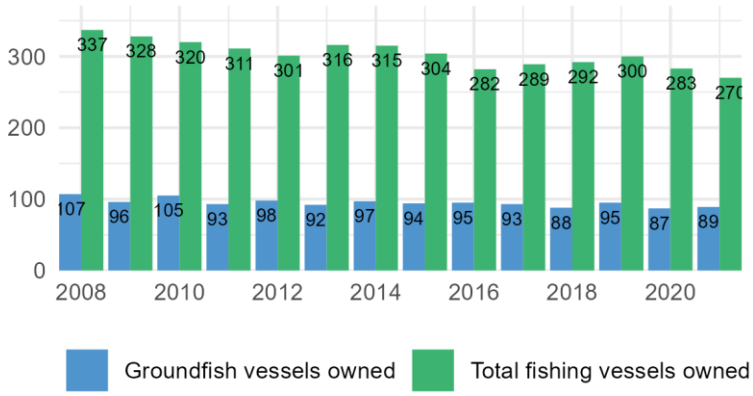
Share of harvest revenue by species

Petersburg 2017-2021 average



Share of revenue by species harvested by resident vessel owners or permit holders (2017-2021 average)

Vessel Ownership Among Residents

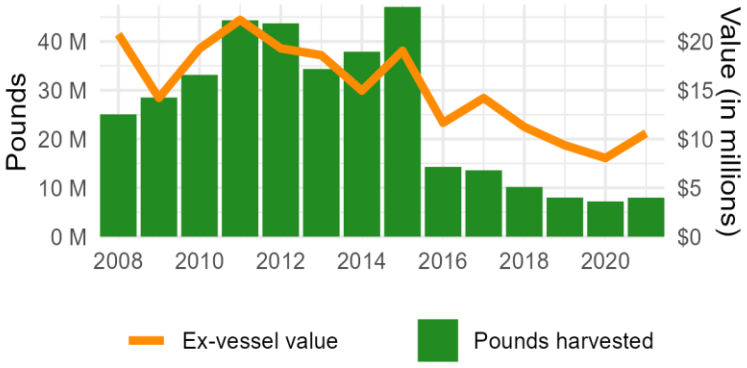


The number of fishing vessels owned by Petersburg residents decreased by 30 vessels from 2019 to 2021 (down 10%). During the same time period, the total number of groundfish vessels registered to Petersburg residents also dropped from a high of 95 to 89 (down 6%), up slightly from a low of 87 in 2020.

GF Harvesting Engagement — *HIGH*

While highly engaged in groundfish fisheries, Petersburg brings harvest revenue from a diverse range of fisheries including 43% of revenue from commercial salmon harvest, 18% from halibut, and 15% from federal crab fisheries. The volume of groundfish harvested in 2021 was 7.9 million pounds with an associated revenue of $10.5 million. When compared to 2019, the 2021 harvest shows a decrease of 24% in pounds harvested and a 13% increase in associated value. Since 2008, groundfish harvested by Petersburg vessels have decreased 68% in volume and 48% in associated revenue. Pacific cod harvests decreased slightly in 2021 compared to 2019, from 5.1 million to 4 million; however this marks an increase from a low of 3 million in 2020.

Groundfish Lbs & Ex-vessel Value Harvested by Residents



Crab Harvesting Engagement — *LOW*

There is not a substantial amount of crab harvesting activity in Petersburg to report.

Due to confidentiality concerns, only select data are available.

Subsistence Harvesting Engagement

Residents of Petersburg are moderately to highly engaged in subsistence harvesting, with 76% of residents utilizing at least one species of crab for subsistence.[7] Rockfish, sablefish and cod are the most utilized groundfish species, according to the most recent data from 2000, and Dungeness, Tanner and Red King Crab are the most widely utilized crab species. Salmon and halibut are also both very important to the community for subsistence and cultural purposes. Traditionally, salmon provided the foundation for almost all aspects of cultural life for the Tlingit and Haida peoples living in the region.[5] Today, it continues to represent an important tribal cultural connection to their homeland and provides a valuable economic and nutritional resource for residents.[5] In 2018, harvests of King salmon were restricted by the Alaska Dept. of Fish and Game, and in 2019, Petersburg saw a significant decline in the number of salmon harvested.[7] This is concerning for residents who rely heavily on this resource. Finally, halibut is also a key subsistence resource for residents, and harvests have remained consistent in recent years.[8] However, concern exists over impacts from climate change on this species' population given that size-at-age has decreased significantly in recent years for this species.[8]

Groundfish Subsistence
Petersburg (2000)*

26.4%
Households using at least one species**

13.6%
Households receiving at least one species**

25,206
Total pounds harvested

10.15
Pounds per capita harvested

****Species include Cod, Walleye Pollock, Flounder, Greenling, Lingcod, Rockfish, Sablefish, Sculpin, and Sole**

Crab Subsistence
Petersburg (2000)*

76.0%
Households using at least one species**

61.6%
Households receiving at least one species**

48,690
Total pounds harvested

16.54
Pounds per capita harvested

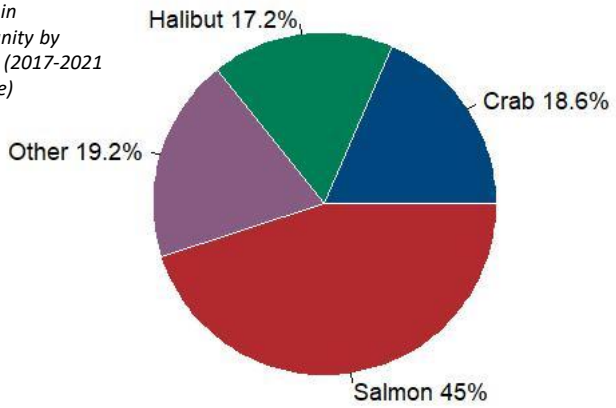
****Species include Dungeness Crab, King Crab, Tanner Crab**

*All subsistence information is from the Community Subsistence Information System (CSIS), ADFG. The CSIS is a repository of Alaska community harvest information gathered on the household level by ADFG, Division of Subsistence. This reflects the most recent data available. While some data are well in the past, they still reflect important information on subsistence activities within the community. These data will be updated as is available.

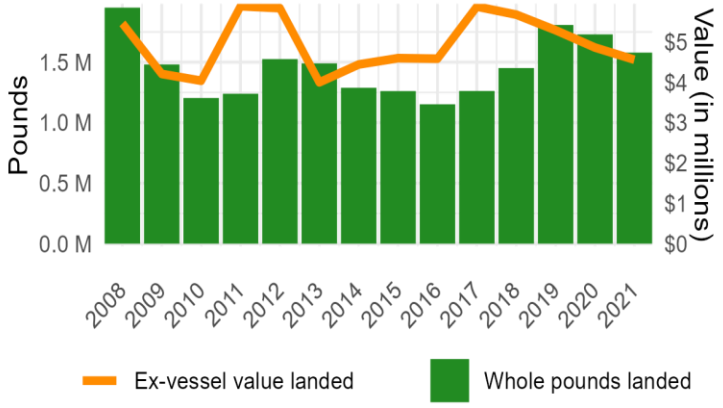
Share of landing revenue by species for Petersburg

combined 2017-2021 average

Share of revenue landed in community by species (2017-2021 average)



Groundfish Lbs Landed & Landed Value



GF Processing Engagement — *MED-HIGH*

The processing sector in Petersburg is dominated by salmon fisheries accounting for 45% of the landed revenue. Across the last five years, crab fisheries accounted for 18.6%, halibut 17.2%, and other fish 19.2%. In 2021, Petersburg had a total of 78 seafood processing facilities, landing a total of 49.5 million pounds of fish at a value of $46.9 million. Of those facilities, 16 processed groundfish, landing a total of 1.5 million pounds of groundfish with an associated value of $4.5 million. Compared to 2019, this marks 12% decrease in volume and a 13% decrease in value. Both landed volume and value have begun a downward trend since 2019 when they peaked. In 2021, groundfish made up 3.1% of total volume landed, and about 9.7% of total value.

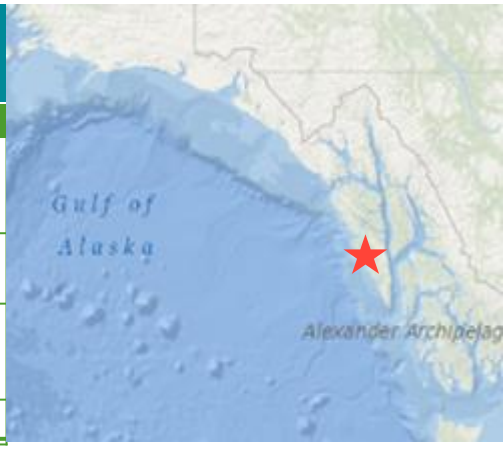
Crab Processing Engagement — *LOW*

There is not a substantial amount of crab processing activity in Petersburg to report.

Due to confidentiality concerns, only select data are available.

Community Sketch

SITKA



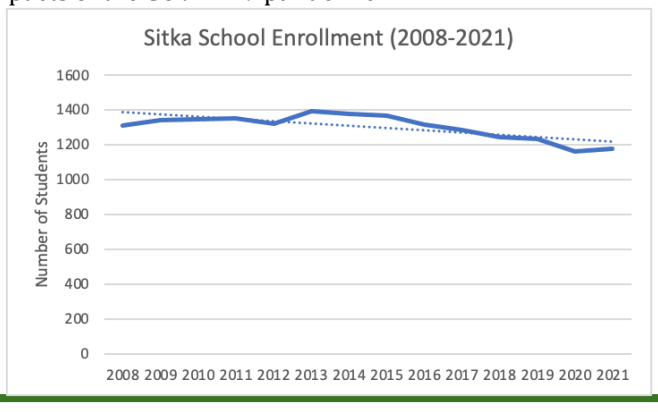
Demographics (self-identified, Census 2020)						
Population	**Gender population (%)**	**Population Over 18 (%)**	**Median household income ($)**	**White (%)**	**American Indian or Alaska Native (%)**	**Black or African American (%)**
8,407	48.6% female 51.4% male	78.7%	$81,708	64.4%	11.5%	0.6%
Below poverty level (%)	**Housing units**	**Population Over 65 (%)**	**High school graduate or higher (%)**	**Asian (%)**	**Native Hawaiian or Pacific Islander (%)**	**Hispanic or Latino (%)**
6.6%	4,150	16.2%	95.2%	7.6%	0.2%	6.9%

Area Description and History

The location of Sitka was settled by the Tlingit several thousand years ago, with the name deriving from the Tlingit Shee At'iká, meaning "People on the Outside of Shee (now Baranof Island)." A Russian expedition arrived in 1741 and by 1808, Sitka was the capital of Russian Alaska. Fur trading and fish canning were mainstays in the town's growth. Sitka was the capital of the Alaska Territory until the government was transferred to Juneau in 1906. In 1878, Sitka became the site of one of the first canneries in Alaska, although the Sitka cannery closed after only two seasons of operation. During the early 1900s, gold mines flourished, and the city was incorporated in 1913. During World War II, the US Navy built an air base on Japonski Island with 30,000 military personnel. Sitka has approximately 1,800 seasonal workers each year: this annual peak in population is mostly driven by fisheries and tourism. The Tlingit people and other residents have historically used a wide variety of marine resources. Subsistence harvests continue to be vital to many, and salmon is an important resource economically and culturally. Sitka was included under the Alaska Native Claims Settlement Act and is recognized as a Native Village.[1] Salmon, herring, groundfish, and halibut fisheries are the main commercial fisheries residents participate in. Pacific cod and lingcod are also harvested in SE Alaska under state regulations. Demersal rockfish are caught as bycatch. A small directed fishery for flatfish (other than halibut) has also taken place, but effort has declined. Pacific halibut fisheries in SE Alaska are managed by the International Pacific Halibut Commission. Sitka is located in Pacific Halibut Fishery Regulatory Area 2C and Federal Statistical and Reporting Area 650.

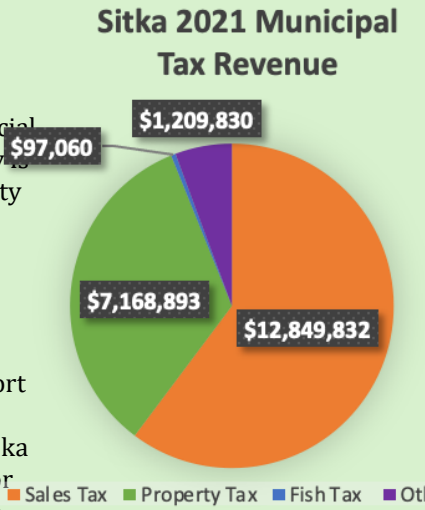
Infrastructure & Transportation

Sitka is accessible by air and water and serviced twice daily with flights to Juneau and Seattle. There are several air taxis and air charters available as well. Sitka operates five small boat harbors with 1,350 slips. The harbors can handle vessels up to 300 feet. A boat launch, haul-out, boat repairs, and other services exist. The privately owned Old Sitka Dock is the only deep water moorage facility in Sitka capable of accommodating large vessels, including cruise ships that frequent the area.[2] The state ferry services Sitka three times a week in the summer, less in the winter. Freight arrives by barge and cargo plane. Water is drawn from a reservoir treated, stored, and piped to nearly all homes. There are two hospitals and coastguard medical facilities. Sitka has 7 schools even schools; enrollment has decreased by 10.2% since 2008, and 5.9% between 2019 and 2020,[3] likely reflecting impacts of the COVID-19 pandemic.



Current Economy

The economy of Sitka is diversified with processing, tourism, government, healthcare, retail, transportation, and commercial fishing. The seafood industry is a major employer. Community leaders reported that Sitka's economy primarily relies on natural resource-based industries such as fishing, ecotourism (e.g. whale watching, kayaking), and sport hunting and fishing. The waterways of Southeast Alaska are an important resource for the tourism industry and the



In 2021, Sitka residents paid $1,188,722 in total fishery related taxes (including shared and municipal).[4] The overall amount of total fish taxes collected in 2021 is the same as that reported in 2019.[4] These revenues support basic city services such as education, sanitation, transportation, etc. and are important indicators of community health and wellbeing. In 2020, per capita income in Sitka was estimated to be $41,082,[5] and the median household income was estimated to be $81,708.[45] This represents a 6.9% increase and a 15.5% increase in these measures respectively compared to 2018. However, the percentage of the population living below the poverty line has decreased by 2.6% since 2018.[5]

Climate Change Vulnerability and Adaptive Capacity

Exposure to Biophysical Effects of Climate Change

A community's exposure to the biophysical effects of climate change, which include effects to the biological organisms and physical landscape surrounding them, aids in determining their vulnerability. Similar to other areas of Alaska, southeast Alaska is already experiencing increasing temperatures and changes in precipitation patterns, including receiving less snow and more rain. Sitka in particular has a long climatological record in comparison to most other Alaskan communities, and scientists have found that temperatures have risen 1.56 degrees since 1827.[6] Changes have also been observed in forest habitats, including declines of yellow cedar trees, and marine habitats, including ocean acidification and increased prevalence of invasive species. These impacts are currently and will continue to impact human health in various ways.[7] However, in comparison to other Alaskan communities who are more vulnerable to erosion, melting sea ice, and permafrost loss, Sitka is at a **low risk of exposure to the biophysical effects of climate change.**

Dependence on Fisheries Impacted by Climate Change

Reliance on fisheries resources which are being impacted by climate change can determine how vulnerable a community is to disruption from climate change. Sitka is highly engaged in harvesting and processing within the groundfish fishery. Tourism and guided tours for recreational fishing are also a substantial industry in Sitka. In addition, Sitka residents are highly engaged in subsistence fishing of particular groundfish and crab species, including rockfish, greenling, lingcod and Dungeness crab. Halibut and salmon are also staple species that are widely utilized in the community.

Given this, Sitka is overall **highly dependent on fisheries resources** that will be impacted by climate change**.** Therefore, as this community is impacted by a changing marine environment, their ability to fish for commercial, recreational, and subsistence purposes will be affected. Residents are highly concerned about impacts to several key species, including salmon, shellfish, eulachon, herring and halibut.[6] In addition, shrimp fisheries were closed in 2021 due to poor population in the area, and restrictions on subsistence and recreational harvests of King salmon went into effect in 2022.[8,9]

Local Adaptive Capacity

Sitka has **medium limitations on its adaptive capacity.** This rating takes into account factors in the community which can make it harder to adapt when disruptions occur. Sitka received a medium rating due to moderate vulnerability of its housing and infrastructure and various characteristics of its population, such as age, income level, economic diversity, education, and population composition. FEMA's National Risk Index also rates Sitka as having very low community resilience,10 meaning they have a very low ability to adapt to changing conditions and withstand and recover rapidly from disruptions.

*Social Indicators for Fishing Communities**

Labor Force:	Low
Housing Characteristics:	Med.
Poverty:	Low
Population Composition:	Low
Personal Disruption:	Low

*Climate Change Vulnerability Ratings***

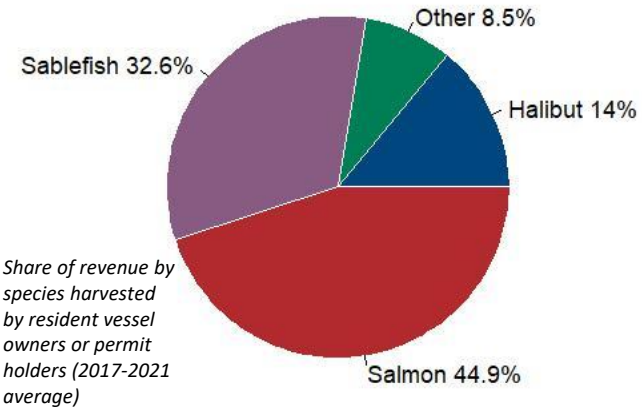
Exposure to Biophysical Effects:	Low
Fisheries Resource Dependence:	High
Limitations on Adaptive Capacity:	Med.

*Source: NOAA Fisheries Office of Science and Technology. 2019. NOAA Fisheries Community Social Vulnerability Indicators (CSVIs). Version 3 (Last updated December 21, 2020). https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities-0

**Source: Himes-Cornell, A., & Kasperski, S. (2015). Assessing climate change vulnerability in Alaska's fishing communities. Fisheries Research, 162, 1–11. https://doi.org/10.1016/j.fishres.2014.09.010

Share of harvest revenue by species for resident owned vessels

Sitka 2015-2021 average

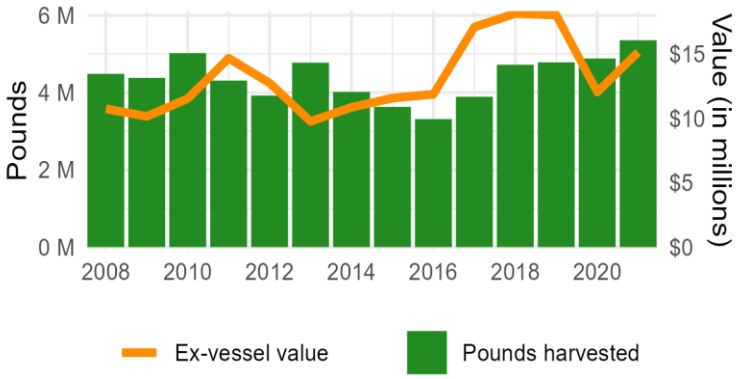


Share of revenue by species harvested by resident vessel owners or permit holders (2017-2021 average)

GF Harvesting Engagement — HIGH

Sitka was among the top ports in Alaska for the volume of groundfish harvested and the associated ex-vessel value in 2021. Other key fisheries include salmon, accounting for 45% of harvest revenue in 2021, and halibut at 14%. In 2021, Sitka fisheries harvested 5.3 million whole pounds of groundfish with and associated value of $15.1 million. Compared to 2019, this represents an increase in volume (up 572,464 pounds or 12%), but a decrease in ex-vessel value (down $2.8 million or 16%). After hitting a low in pounds harvested in 2016 (3.3 million pounds), the volume of groundfish fisheries harvested has steadily risen. Ex-vessel value peaked in 2018 at $18 million, but steeply declined in 2020 and has only rebounded slightly. Sitka residents largely participate in groundfish fisheries with longline vessels that target sablefish in State and federal waters. The former necessitates a State limited entry permit while the latter necessitates quota shares.

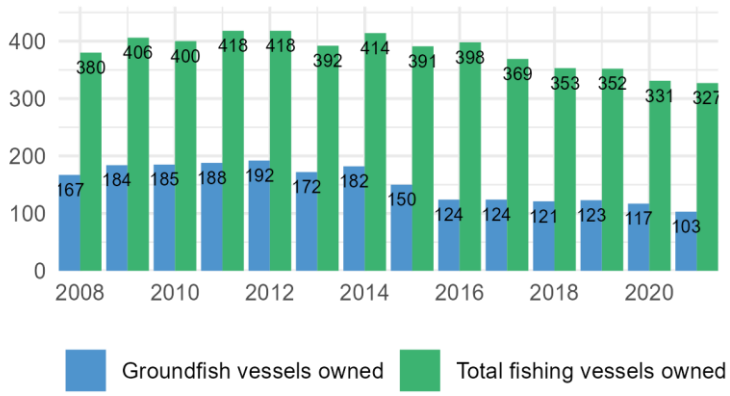
Groundfish Lbs & Ex-vessel Value Harvested by Residents



In 2021, the number of groundfish vessels owned by Sitka residents decreased by 20 for a total of 103 vessels. The total number of fishing vessels owned by residents is 327. Between 2008 and 2021, the number of groundfish vessels owned by Sitka residents fluctuated, peaking in 2012 at 192 vessels.

Community leaders noted that commercial fishing boats under 125 feet use Sitka as their base of operations during the fishing season. While the typical vessel ranges between 30 and 600 feet in length, there is a high number of small vessels less than 30 feet that use the Sitka port.

Vessel Ownership Among Residents



Sablefish

Anoplopoma fimbria

Also Known As: Black cod, Butterfish, Skil, Beshow, Coalfish
REGION: Alaska, West Coast

Crab Harvesting Engagement — N/A

There is not a substantial amount of crab harvesting activity in Sitka to report.
Due to confidentiality concerns, only select data are available.

Subsistence Harvesting Engagement

The community of Sitka is highly engaged in subsistence fishing within the groundfish and crab fisheries, particularly for rockfish, greenling, lingcod, and Dungeness crab, which are the most widely utilized species from these fisheries. The community overall harvested approximately 22.42 pounds of groundfish per capita in 2013. This represents a significant nutritional source for residents. In addition, the people of Sitka are highly engaged in subsistence harvests of halibut and salmon, according to Alaska Dept. of Fish and Game data. Their engagement with these fisheries has remained relatively constant in recent years, despite recent observed declines in salmon species and restrictions on subsistence harvests in the area.[7,11,12,13] Traditionally, salmon provided the foundation for almost all aspects of cultural life for the Tlingit and Haida peoples living in the region.

Today, it continues to represent an important tribal cultural connection to their homeland and provides a valuable economic and nutritional resource for residents. Halibut is also a key subsistence resource for residents, however concern exists over impacts from climate change on this species' population given that size-at-age has decreased significantly in recent years for this species.[7]

Groundfish Subsistence
Sitka (2013)*

54.9%
Households using at least one species**

25.3%
Households receiving at least one species**

176,511
Total pounds harvested

22.42
Pounds per capita harvested

****Species include Cod, Sole, Sculpin, Sablefish, Rockfish, Flounder, Greenling, Lingcod and Perch**

Crab Subsistence
Sitka (2013)*

50.3%
Households using at least one species**

31.1%
Households receiving at least one species**

60,753
Total pounds harvested

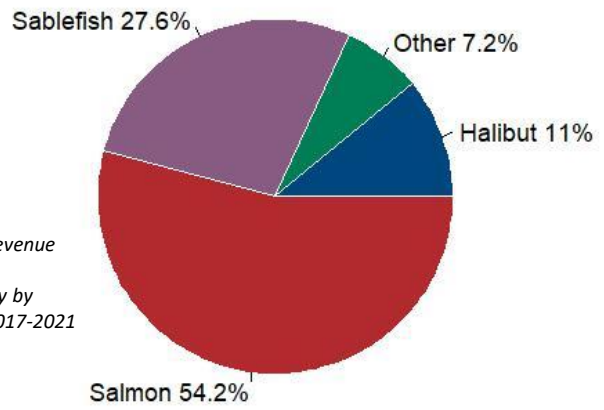
7.72
Pounds per capita harvested

****Species include Dungeness, King, Tanner Crab**

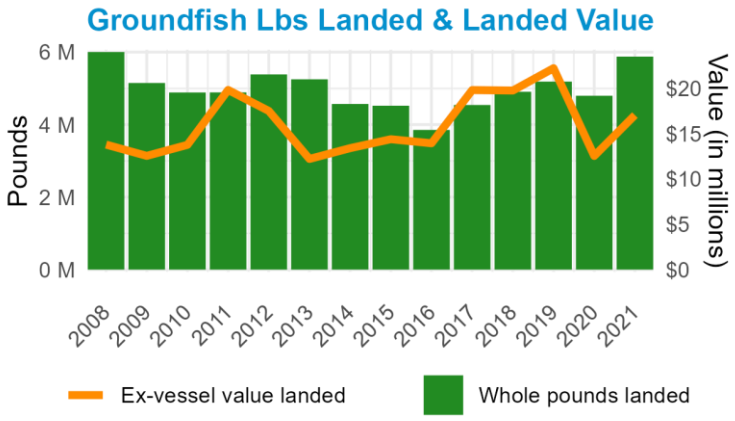
*All subsistence information is from the Community Subsistence Information System (CSIS), ADFG. The CSIS is a repository of Alaska community harvest information gathered on the household level by ADFG, Division of Subsistence. This reflects the most recent data available. While some data are well in the past, they still reflect important information on subsistence activities within the community. These data will be updated as is available.

Share of landing revenue by species

combined 2017-2021 average



Share of revenue landed in community by species (2017-2021 average)



GF Processing Engagement — *HIGH*

The majority of processing activity is for salmon (54.2%), although sablefish made up 27.6% of total processing revenue across the last five years, and halibut accounted for 11%. In 2021, three processing facilities in Sitka processed Pacific cod, six processed rockfish, and five processed sablefish. Together they landed 5.8 million pounds, with an associated value of $17 million. This marks an increase of 690,143 pounds (13%) and a decrease of $5.1 million (23%) from 2019. While pounds landed only decreased slightly in 2020, associated revenue declined sharply but rebounded some in 2019.

Crab Harvesting Engagement — *N/A*

There is not a substantial amount of crab processing activity in Sitka to report.

Due to confidentiality concerns, only select data are available.

Community Sketch SEWARD

Demographics (self-identified, ACS 2020)

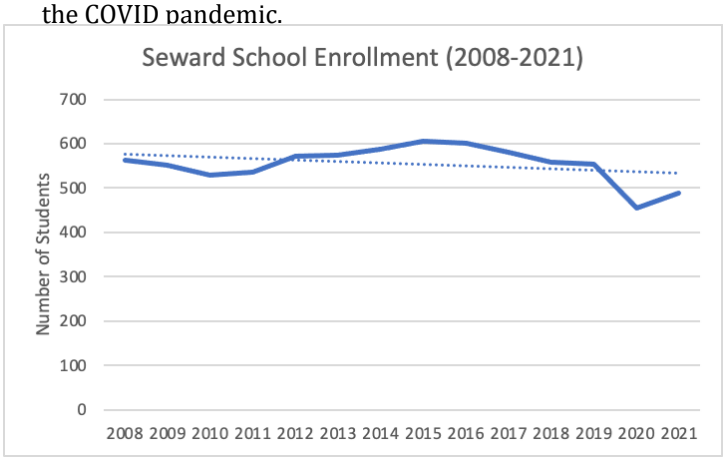
Population	Gender population (%)	Population Under 5 (%)	Median household income ($)	White (%)	American Indian or Alaska Native (%)	Black or African American (%)
2,812	38.3% female 61.7% male	5.5%	$74,110	75.9%	12.8%	2.6%
Below poverty level (%)	**Housing units**	**Population Over 85 (%)**	**High school graduate or higher (%)**	**Asian (%)**	**Native Hawaiian or Pacific Islander (%)**	**Hispanic or Latino (%)**
4.7%	1,207	2.3%	93.2%	1.6%	3.0%	9.0%

Area Description and History

Seward is located at the head of Resurrection Bay on the Kenai Peninsula, and is the gateway to the Kenai Fjords National Park. The earliest residents of Seward were the Unegkurmiut, a subgroup of the Alutiiq Chugash. The City was founded in 1903 and, as an ice-free harbor, Seward has become an important transport and supply center for Interior Alaska. Seward was incorporated in 1912, and became a strategic military port during WWII. Seward was not included under the Alaska Native Claims Settlement Act, although the Qutekcak Native tribe is very active in the area and is seeking federal recognition. Qutekcak translates from the Alutiiq language as "Big Beach.". Qutekcak was a prehistoric Alaska Native mixing area, serving as a crossroads for the various Alutiiq and Sugpiaq groups residing in the region.[1] The first commercial salmon fishery in Prince William Sound (PWS) developed along the Copper River Delta around 1900. Commercial exploitation of halibut and groundfish first extended into the Gulf of Alaska (Gulf) in the 1920s and, also during that time, herring became increasingly valued for oil and meat, and a number of reduction plants were built. Commercial crab fisheries began to develop in the Gulf in the 1930s. The marine waters at the outlet of Resurrection Bay are included within Federal Statistical and Reporting Area 630, Pacific Halibut Fishery Regulatory Area 3A, and the Central Gulf Sablefish Regulatory Area. In addition to federal groundfish fisheries that take place in the Central and Eastern Gulf, state groundfish fisheries take place in the inland waters of Cook Inlet and PWS for rockfish, lingcod, pollock, sablefish, and Pacific cod.

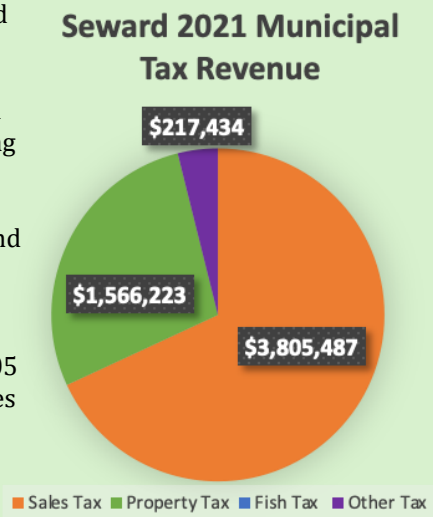
Infrastructure & Transportation

Seward is accessible by air, water, highway and rail. Bus and other commercial trucking services are available daily from Anchorage. The deep water port remains ice free year round, and services cruise ships, and other cargo barges from Seattle. The small boat harbor has slips for 650 boats. All water, waste collection, and power services are offered through the city and the borough. Medical services in Seward are provided by the Providence Seward Medical Center. ADF&G and NMFS both have offices in Seward. Seward has 3 schools, where student enrollment has decreased by 13% since 2008.[2] Additionally, Seward schools experienced a 18% decrease between 2019 and 2020,[2] which is likely a result of the COVID pandemic.



Current Economy

Seward's economy is based off its role as a transportation hub. The economy is diversified and includes commercial fishing and processing, shipping, coal export, employment through the state prison and tourism fueled by the proximity of Kenai Fjords National Park. In 2021, Seward generated $351,805 in total fishery related taxes (including shared and municipal).[3] The overall amount of total fish taxes collected in 2021 only increased by 0.4% from 2019.[3]



These revenues support basic city services such as education, sanitation, transportation, etc. and are important indicators of community health and wellbeing. In 2020, per capita income in Seward was estimated to be $30,301,[4] and the median household income was estimated to be $74,110.[4] This represents a 6.1% increase and a 0.7% increase in these measures respectively compared to 2018. However, the percentage of the population living below the poverty line has decreased by 7% since 2018.[4]

Climate Change Vulnerability and Adaptive Capacity

Exposure to Biophysical Effects of Climate Change

A community's exposure to the biophysical effects of climate change, which include effects to the biological organisms and physical landscape surrounding them, aids in determining their vulnerability. Biophysical risks to the Gulf of Alaska as a whole include sea level rise, coastal erosion, changes in precipitation, and increased storm severity.[5] Overall, Seward has a **low level of biophysical risk** from the effects of climate change compared to other Alaskan communities who are more vulnerable to erosion, melting sea ice, and permafrost loss. Specific climate resiliency or action plans have not yet been drafted by the city of Seward, but a recent community forum from 2019 on the topic of a climate action plan indicates that residents are concerned about flooding, droughts, wildfires, sea level rise and various impacts of climate change on ocean health including acidification, toxic algae blooms, glacial melts and increased shipping and tourism.[6] The FEMA National Risk Index also rates the Kenai Peninsula as a whole as being moderately vulnerability to various natural hazards and risks.[7]

Dependence on Fisheries Impacted by Climate Change

Reliance on fisheries resources which are being impacted by climate change can determine how vulnerable a community is to disruption from climate change. The community of Seward is highly engaged in processing within the groundfish fishery. In addition, nearby Kenai Fjords National Park is a popular destination for recreational fishing, with 28 active sport fish guide businesses, making this an important part of the community's culture and economy. However, residents appear to be only moderately engaged in subsistence fishing within the groundfish and crab fisheries in comparison to other communities. The most widely utilized species include rockfish, greenling, lingcod and King crab. They are also only moderately engaged in halibut subsistence fishing, but highly engaged in salmon subsistence fishing.

Given this, Sitka is overall **moderately dependent on fisheries resources** that will be impacted by climate change**.** Therefore, as this community is impacted by a changing marine environment, the community's well-being will be significantly affected.

Local Adaptive Capacity

The community of Seward has **medium limitations on its adaptive capacity.** This rating takes into account factors in the community which can make it harder to adapt when disruptions occur. Sitka received a medium rating due to moderate vulnerability of its housing and infrastructure and various characteristics of its population, such as age, income level, economic diversity, education, and population composition. The FEMA National Risk Index also rates Seward as having very low community resilience, meaning they have a very low ability to adapt to changing conditions and withstand and recover rapidly from disruptions.[7]

*Social Indicators for Fishing Communities**

Labor Force:	Low
Housing Characteristics:	Med-High
Poverty:	Med-High
Population Composition:	Low
Personal Disruption:	Med.

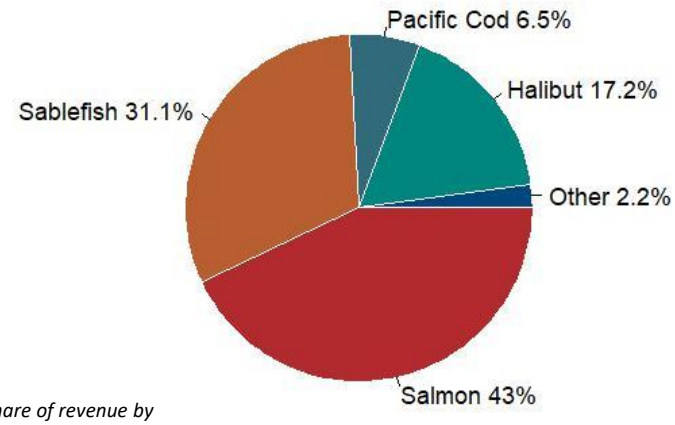
*Climate Change Vulnerability Ratings***

Exposure to Biophysical Effects:	Low
Fisheries Resource Dependence:	Med.
Limitations on Adaptive Capacity:	Med.

*Source: NOAA Fisheries Office of Science and Technology. 2019. NOAA Fisheries Community Social Vulnerability Indicators (CSVIs). Version 3 (Last updated December 21, 2020). https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities-0

**Source: Himes-Cornell, A., & Kasperski, S. (2015). Assessing climate change vulnerability in Alaska's fishing communities. Fisheries Research, 162, 1–11. https://doi.org/10.1016/j.fishres.2014.09.010

Share of landed revenue by species for resident owned vessels *Seward 2015-2021 average*

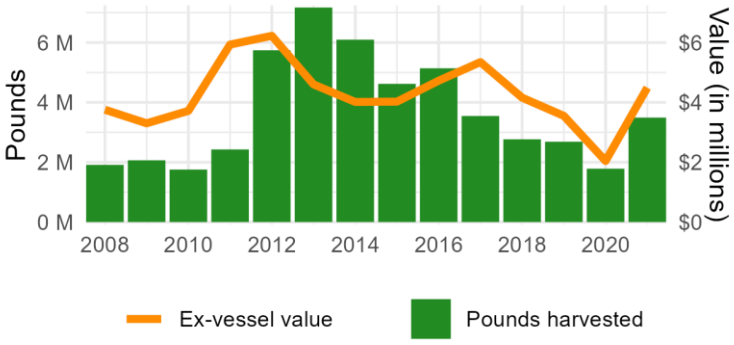


Share of revenue by species harvested by resident vessel owners or permit holders (2017-2021 average)

GF Harvesting Engagement LOW

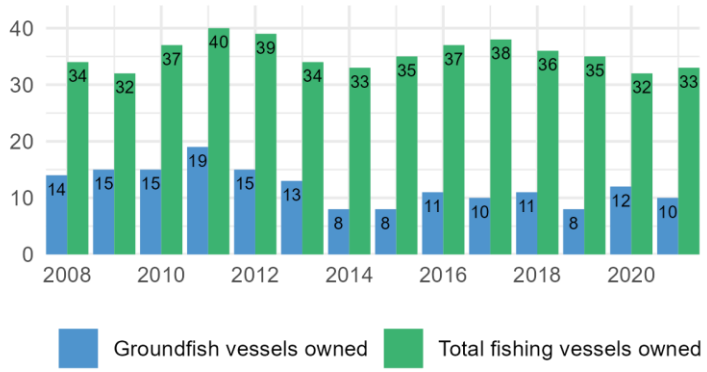
Seward participates in several fisheries. About 37.6% of ex-vessel value is from groundfish fisheries, while 17.2% from halibut fisheries, and 43% from salmon. In 2021, vessels owned by Seward residents harvested 3.4 million pounds of groundfish with an associated value of $4.4 million. This marks a significant increase from 2019 in volume harvested (up 806,526 pounds or 30%) and a substantial increase in value ($945,174 or 26%). Groundfish harvests in Seward peaked in 2013, but have been declining since. The increase seen in 2021 in both pounds harvested and associated value mean levels have returned to approximately what they were in 2017. This is a change after several recent years of decline, including a sharp decline in both pounds harvested and revenue in 2020, potentially due to the COVID-19 pandemic.

Groundfish Lbs & Ex-vessel Value Harvested by Residents



In 2021, the number of groundfish vessels owned by Seward residents increased since 2019 to a total of 10 vessels. However, the total number of fishing vessels owned by residents decreased to 33. Between 2008 and 2019, the number of groundfish vessels owned by Seward residents fluctuated, peaking in 2011 at 19 vessels. Interestingly, despite the decrease in pounds harvested in 2020, the number of groundfish vessels owned increased to 12 that year.

Vessel Ownership Among Residents

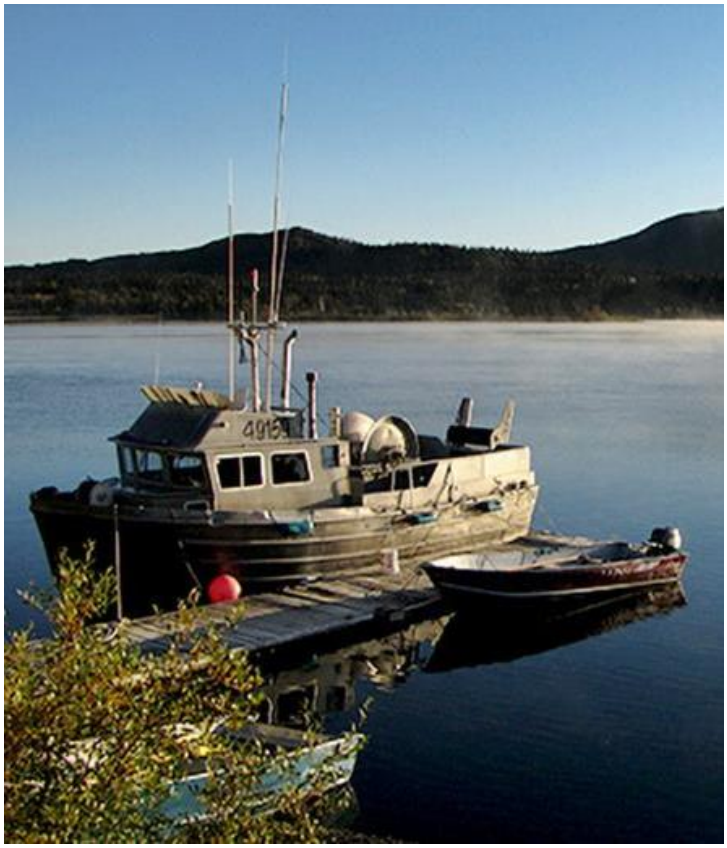


Crab Harvesting Engagement *N/A*

There is not a substantial amount of crab harvesting activity in Seward to report.
Due to confidentiality concerns, only select data are available.

Subsistence Harvesting Engagement

Residents of Seward are moderately engaged in subsistence fishing with the groundfish and crab fisheries, according to the most recent data available. The most popular groundfish species were rockfish, greenling and lingcod, while the most widely utilized crab species were King crabs. Similarly, residents are only moderately engaged in subsistence halibut harvests. Recorded harvests of halibut shrank to 0 in the most recent year data was available, 2016. However, Seward residents are highly engaged in subsistence fishing of salmon, and have been consistently since 2015. Harvests of subsistence salmon saw a dramatic increase in the most recent year data was available, 2019. That year, the number of ADFG salmon permits issued increased 396% compared to the previous year, 2018. This also led to a dramatic increase in the number of salmon harvested.[8,9] This same trend was observed in the nearby Kenai Peninsula community of Homer, which also saw dramatic increases in salmon harvests in 2019 due to a record salmon run that year.[10]



Groundfish Subsistence
Seward (2000)*

29.8%
Households using at least one species**

16.3%
Households receiving at least one species**

33,168
Total pounds harvested

7.3
Pounds per capita harvested

****Species include Cod, Walleye Pollock, Flounder, Greenling, Lingcod, Rockfish, Sablefish, Sculpin and Sole**

Crab Subsistence
Seward (2000)*

13.5%
Households using at least one species**

11.5%
Households receiving at least one species**

7,416
Total pounds harvested

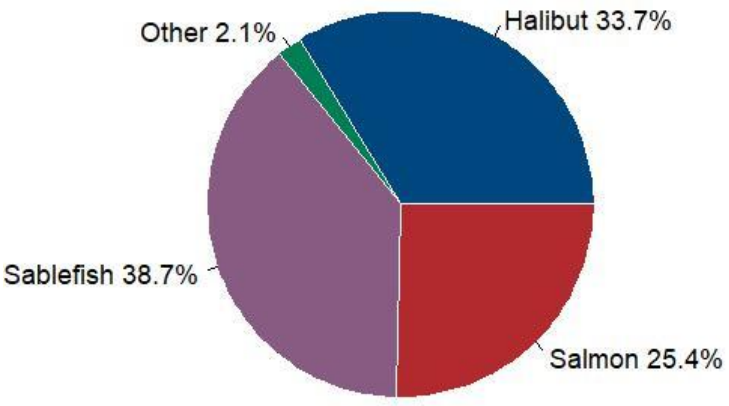
1.6
Pounds per capita harvested

****Species include Dungeness, King and Tanner Crab**

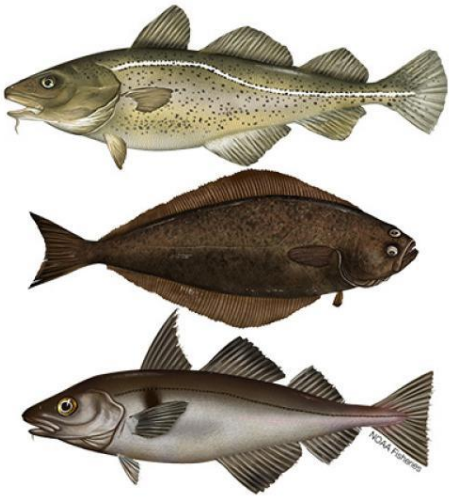
*All subsistence information is from the Community Subsistence Information System (CSIS), ADFG. The CSIS is a repository of Alaska community harvest information gathered on the household level by ADFG, Division of Subsistence. This reflects the most recent data available. While some data are well in the past, they still reflect important information on subsistence activities within the community. These data will be updated as is available.

Share of landing revenue by species for Seward

combined 2017-2021 average



Share of revenue landed in community by species (2017-2021 average)

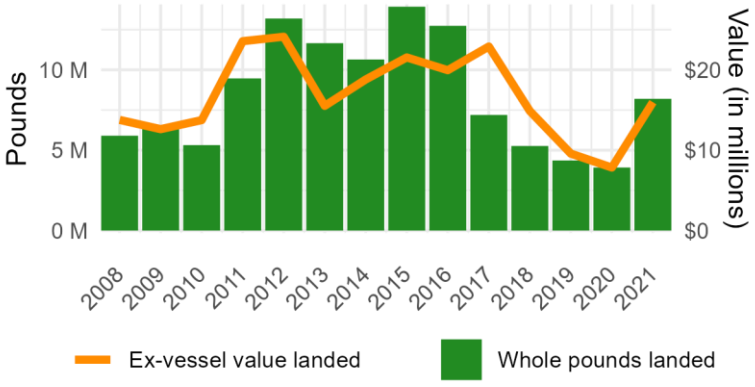


Northeast Multispecies (Groundfish)

GF Processing Engagement — MED-HIGH

In 2021, there were five processing plants in Seward that processed groundfish. Processing facilities landed 8.1 million whole pounds with an associated value of $15.9 million. This shows an increase of 3.8 million pounds (87%) and $6.4 million (66.9%) in landed value from 2019. After several years of declining pounds landed and revenues from groundfish since 2015, this marks the first increase in both of these measures since that time. Pounds landed of Pacific cod in particular increased significantly since 2019, increasing by 1.1 million pounds, or 160%.

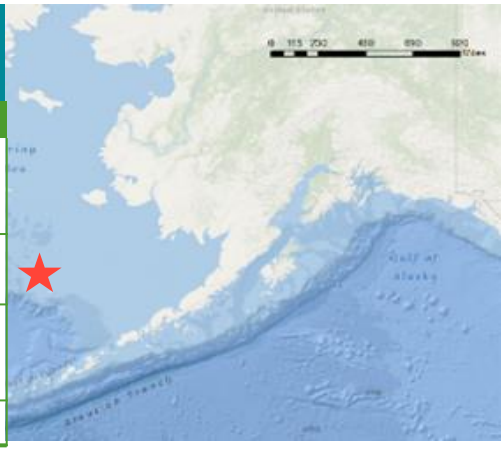
Groundfish Lbs Landed & Landed Value



Crab Harvesting Engagement — N/A

There is not a substantial amount of crab processing activity in Seward to report.
Due to confidentiality concerns, only select data are available.

Community Sketch SAINT PAUL



Demographics (self-identified, ACS 2020)

Population	Gender population (%)	Pop. Under 5 (%)	Median household income ($)	White (%)	American Indian or Alaska Native (%)	Black or African American (%)
399	32.8% female 67.2% male	5.8%	$63,571	4.8	84.0%	2.0%

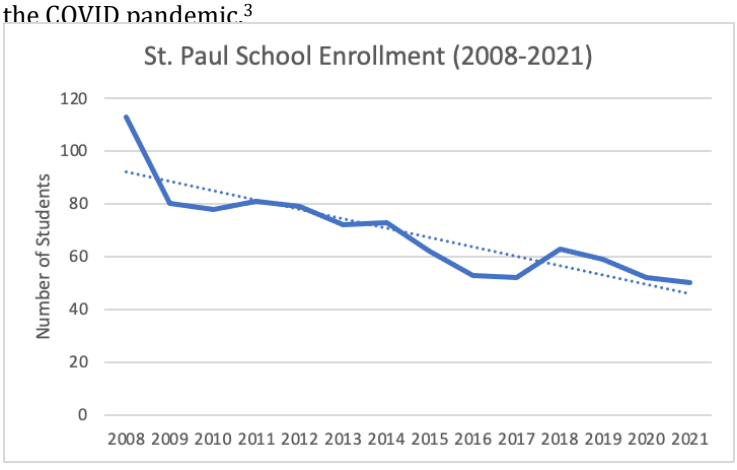
Below poverty level (%)	Housing units	Population Over 85 (%)	High school graduate or higher (%)	Asian (%)	Native Hawaiian or Pacific Islander (%)	Hispanic or Latino (%)
22.5%	162	0%	55.5%	0.5%	0.0%	9.3%

Area Description

St. Paul is located on the southern tip of St. Paul Island, the largest of the Pribilof Islands, located north of the Aleutians in the Bering Sea.The native community name is Tanaxˆ Amixˆ, and the native language spoken is Unangan Aleut. St. Paul was likely unpopulated until the arrival of the Russians, although Unangaŝ oral history acknowledges Native knowledge and use as a seasonal hunting ground on this island group before Russian contact. In 1786, Russian fur traders discovered St. Paul and relocated Aleuts from Siberia, Atka and Unalaska to hunt fur seals, and their descendants live on St. Paul today. In 1983, Congress passed the Fur Seal Act Amendments, which ended government control of the seal harvest, as well as Federal presence on St. Paul. Community services are provided by local government. St. Paul was included under the Alaska Native Claims Settlement Act (ANCSA), and is federally recognized as a Native Village. Native associations and Corporations include the Aleutian Pribilof Islands Association and Tanadgusix Corporation. In addition to fur seal, residents of Saint Paul have historically harvested seal, sea lion, and halibut for subsistence purposes. Saint Paul is located within Pacific Halibut Fishery Regulatory Area 4C, Federal Statistical and Reporting Area 513, and the Bering Sea Sablefish Regulatory Area. Currently, the greatest number of Saint Paul residents participate in the commercial halibut fishery, while a smaller number of residents are also involved in fisheries for groundfish, crab, and salmon.

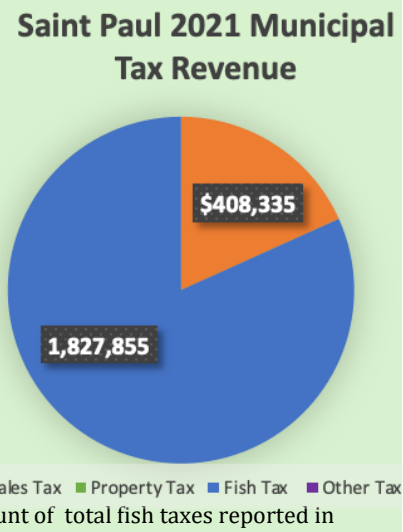
Infrastructure & Transportation

St. Paul is accessible by air and water, and has regularly scheduled flights. There is a State owned gravel runway that is 6,500 feet, as well as a breakwater, with 700 feet of dock space. Most freight arrives by barge with approximately 6 cargo ships arriving from Seattle each year, Water is supplied by wells and an aquifer, and is piped to all homes. There is one local health clinic, though with the closures of Bering Sea snow crab fisheries in October 2022 and Bristol Bay king crab fishery closures in 2021, budgetary cuts threaten medical services.[1,2] There is one school in St Paul; enrollment has decreased by 55.8% from 2008-2021.[2] School enrollment remains a concern, as the only other school in the Pribilofs located on St. George closed in 2018. From 2019 to 2020, there was an 11.9% decrease in student enrollment likely linked to the COVID pandemic.[3]

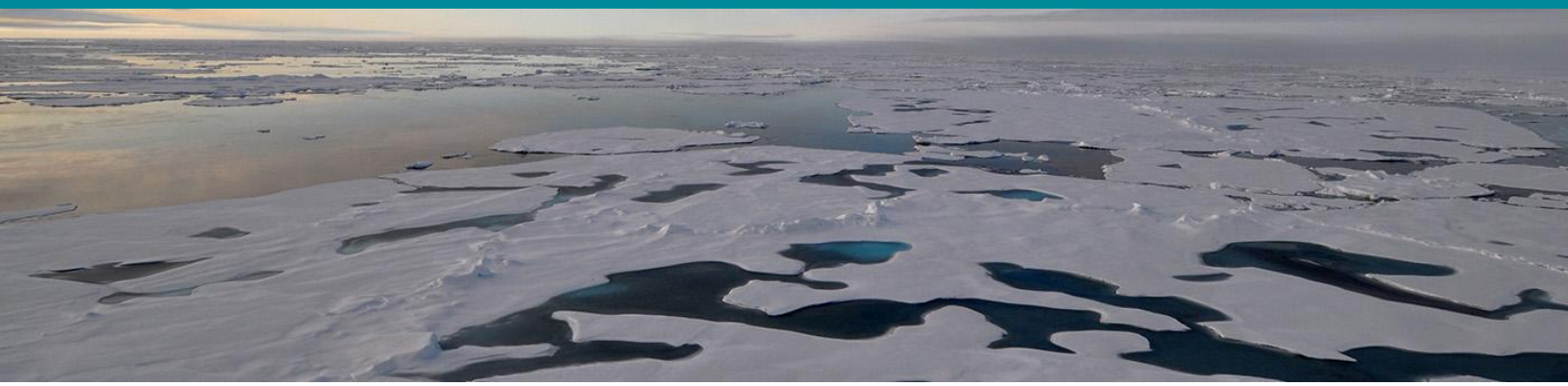


Current Economy

The federally controlled fur seal industry dominated the economy at St. Paul until 1985. Since then, the economy has transitioned to servicing the commercial fishing industry, and the city is a port for the Central Bering Sea fishing fleet. There is a local commercial halibut fishery, a Trident Seafoods processing plant, as well as up to nine offshore processing plants that are serviced out of St. Paul. Ecotourism, reindeer harvesting and local government jobs provide additional sources of income. In 2021, Saint Paul generated $2,671,138 in total fishery related taxes (including shared and municipal).[4] The overall amount of total fish taxes reported in 2021 were the same as total fish taxes reported from 2019. These revenues support basic city services such as education, sanitation, transportation, etc. and are important indicators of community health and wellbeing. In 2020, per capita income in Saint Paul was estimated to be $27,829, and the median household income was estimated to be $63,571. This represents a 18.3% decrease and a 0% change in these measures respectively compared to 2018. However, the percentage of the population living below the poverty line has increased by 9.8% since 2018.[5] The per capita income in past 12 months for St. Paul is 25.0% lower than the 2020 Alaska mean per capita income in the past 12 months from 2016-2020 of $37,094.[5] The median household income for St Paul is 18.3% less than the 2020 statewide Alaska median household income (in 2020 dollars) between 2016-2020 of $77,790.[5] With the closures of Bering Sea snow crab and Bristol Bay king crab fisheries, St. Paul's economy, which is 90% dependent on snow crab is facing an estimated $2.7 million hit to their economy.[1,2,6,7]



SAINT PAUL



Climate Change Vulnerability and Adaptive Capacity

Exposure to Biophysical Effects of Climate Change

The Bering Sea as a whole has experienced loss of sea ice, increasing temperatures, changes in precipitation, and more frequent and higher storm surges.[8,9] These changes can impact health, livability, food and economic security, and the ecology of the area. Overall, compared to other Alaskan communities, St. Paul has a **medium risk of exposure to the biophysical effects of climate change.**

Dependence on Fisheries Impacted by Climate Change

The city of St. Paul is highly engaged in processing for the crab fishery. Recreational fishing is also a significant part of the local economy, particularly from ecotourism. They are also highly engaged in subsistence fishing, particularly of crab and halibut. Overall, they are **moderately dependent on fisheries resources** that will be impacted by climate change. As species compositions and distributions change due to warming oceans and acidification, they will likely impact the community of St. Paul. In 2021, a cancellation of the winter Red King Crab fishery impacted this community, and more recently declines of snow crab species have impacted them as well.[2,6,7] Specifically, these impacts have caused an estimated $3.25 million in lost tax revenue and could result in service cuts for the local government. These negative impacts continued in 2022 when both the Snow crab fishery and the Bristol Bay Red King crab fishery were closed [6,7] due to concerns over population levels which have struggled due to warming oceans.[9]

Local Adaptive Capacity

The city of St. Paul has **high limitations on its adaptive capacity.** This is because it has medium to high levels of poverty and infrastructure which is vulnerable to natural hazards at a medium to high level. The National Risk Index also indicates that St. Paul has a very low ability to prepare for natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to other communities in the U.S. because of these factors and others. [10] St. Paul is highly vulnerable to shocks and disruptions related to changes in fisheries resources in ways which could impact the community's ability to engage successfully in these fisheries.

Social Indicators for Fishing Communities (8)

Labor Force:	Low
Housing Characteristics:	Med-High
Poverty:	Med-High
Population Composition:	Low
Personal Disruption:	Low

Climate Change Vulnerability Ratings (7)

Exposure to Biophysical Effects:	Med.
Fisheries Resource Dependence:	Med.
Limitations on Adaptive Capacity:	High

*Source: NOAA Fisheries Office of Science and Technology. 2019. NOAA Fisheries Community Social Vulnerability Indicators (CSVIs). Version 3 (Last updated December 21, 2020). https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities-0

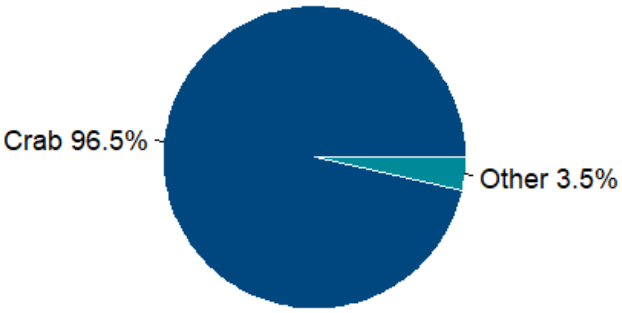
**Source: Himes-Cornell, A., & Kasperski, S. (2015). Assessing climate change vulnerability in Alaska's fishing communities. Fisheries Research, 162, 1–11. https://doi.org/10.1016/j.fishres.2014.09.010

GF and Crab Harvesting Engagement — LOW

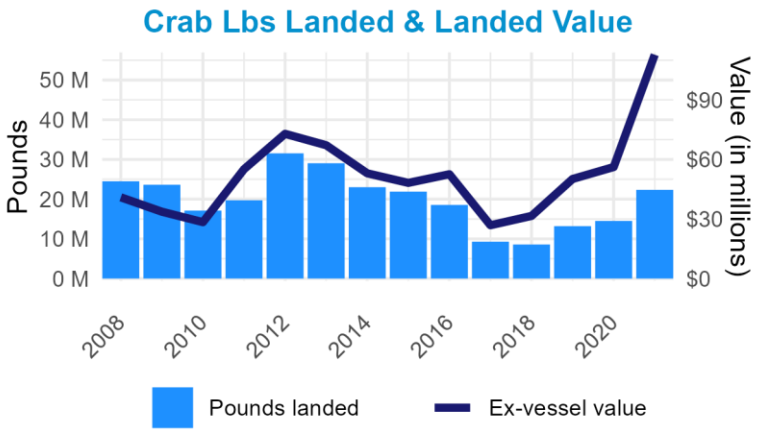
Halibut is the primary target fishery for St. Paul. 1.5 million pounds of halibut was harvested in St. Paul in 2019. Groundfish fisheries account for less than one percent of harvest. There is not a substantial amount of groundfish harvest activity in St. Paul to report.
Due to confidentiality concerns, only select data are available.

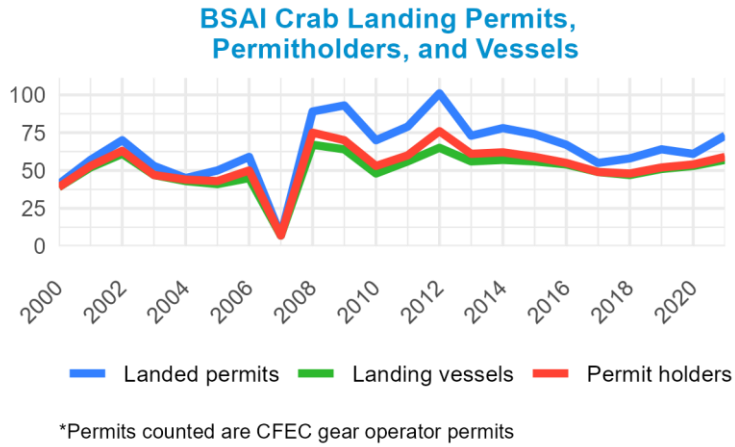
Share of landing revenue by species for St. Paul

combined 2017-2021 average



Share of revenue landed in community by species (2017-2021 average)





*Permits counted are CFEC gear operator permits

GF Processing Engagement — LOW

There is not a substantial amount of groundfish processing activity in St. Paul to report.
Due to confidentiality concerns, only select data are available.

Crab Processing Engagement — HIGH

The majority of processing activity in St. Paul is for crab (94% of landed revenue). Halibut accounts for 6% of landed revenue. In 2019, the island of St. Paul had six processing facilities, which landed 13.2 million pounds of crab with an associated value of $40.7 million. This marked an increase from the last two previous years; however compared to the previous five year average, there was an overall decreased in volume by 1.1 million pounds (8%) and increase of $39 million (4%) in landeex-vessel value. After hitting a peak in 2012 of 31.5 million pounds and $73 million landed revenue, crab processing began a steady decline with a sharp uptake in 2019.

The number of landing permits in St. Paul increased slightly since 2018 from 58 to 64 (up 10%), while the number of permit holders increased from 48 to 52 (up 8%). Compared to the previous five year average, the number of permits remained steady while permit holders fell by 1%.

Subsistence Harvesting Engagement

Though subsistence was not historically practiced in local culture, today halibut and seal comprise many subsistence practiced on the island in exchange with other communities for salmon. The most recent subsistence data publicly available is from 2017 and is comprised of Stellar sea lions and harbor seals. To remain consistent in our analysis across communities, we used the most recent groundfish and crab subsistence data to determine their engagement within these fisheries.[11] While this data from 1994 is outdated, it does provide a snapshot into the historic use of these fisheries in St. Paul. Historically, St. Paul residents have been widely engaged in subsistence uses of the crab fishery, as well as harvested a significant number of pounds per capita from the groundfish fishery, although these resources are not as widely used. [11]

St. Paul residents are also engaged heavily in subsistence harvesting of halibut. [12] In 1994, 90.5% of households reported harvesting halibut, and according to more recent data, harvests of halibut, while fluctuating, have remained a constant activity for St. Paul residents.[12]

Groundfish Subsistence
St. Paul (1994)

11.9%
Households using at least one species*

4.8%
Households receiving at least one species*

6,249
Total pounds harvested

12.68
Pounds per capita harvested

*Species include Pacific Cod, Flounder, Greenling, Rockfish, Sablefish, and Sculpin

Crab Subsistence
St. Paul (1994)

46.4%
Households using at least one species*

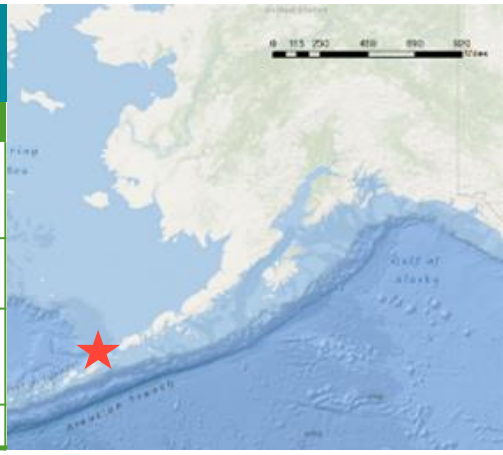
45.2%
Households receiving at least one species*

575
Total pounds harvested

1.17
Pounds per capita harvested

*Species include Tanner Crab, Hair Crab, King Crab, Blue King Crab

Community Sketch UNALASKA



Demographics (self-identified, ACS 2020)

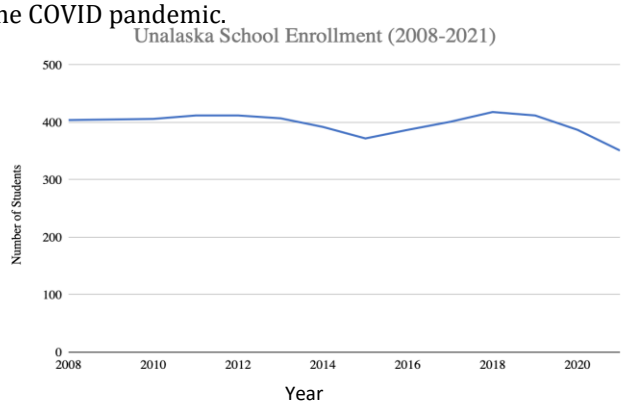
Population	Gender population (%)	Population Under 5 (%)	Median household income ($)	White (%)	American Indian or Alaska Native (%)	Black or African American (%)
4,758	36.8% female 63.2% male	3.6%	$90,938	26.5%	2.5%	2.6%
Below poverty level (%)	**Housing units**	**Population Over 85 (%)**	**High school graduate or higher (%)**	**Asian (%)**	**Pacific Islander (%)**	**Hispanic or Latino (%)**
2.0%	1,319	0.3%	91.5%	48.8%	2.5%	14.9%

Area Description and History

Unalaska overlooks Iliuliuk Bay and Dutch Harbor on Unalaska Island in the Aleutian Chain. The area has been inhabited for thousands of years by the Unangan. When commerce with Russian fur traders began in 1759, more than 3,000 Unangan lived in 24 settlements on Unalaska and Amaknak Islands. The City of Unalaska was incorporated in March 1942. In the early 20th century, seafood processing of salmon, herring, and cod was established. By the 1940s, the military presence in the region overshadowed commercial fishing, and Dutch Harbor was mostly repurposed as a naval port. After World War II, halibut, salmon, and king crab fisheries began in the 1960s, bringing an economic boom in the 1970s. When king crab stocks collapsed in the early 1980s, Unalaska began to transition to groundfish fisheries. Today, Unalaska's International Port of Dutch Harbor is the top commercial fishing port in the nation. An estimated 2,500 seasonal workers come to Unalaska for fisheries employment each year.[1] The population of Unalaska reaches its annual peak between January and April each year (during Pollock "A" Season). In 2010, 2,099 residents lived in group quarters, which is associated with processor housing.[1] Unalaska was included under the Alaska Native Claims Settlement Act (ANCSA) and is federally recognized as a Native village. The active Native Corporations are Ounalashka Corporation and Aleut Corporation. The area is included in Federal Statistical and Reporting Area 610, Pacific Halibut Fishery Regulatory Area 4A, and the Western Gulf of Alaska Sablefish Regulatory Area. Unalaska is in House District 37, Senate District S.

Infrastructure & Transportation

Unalaska is serviced by daily scheduled flights from Anchorage. The state ferry operates bi-weekly from Homer between May and September. There are six marine facilities in Unalaska which include 10 docks, three operated by the city.[2] Dutch Harbor has 5,200 ft. of moorage and 1,232 ft. of floating dock, accommodating vessels up to 200 feet, and 238 moorage slips. The Unalaska Marine Center and U.S. Coast Guard Dock offer cargo, passenger, and other port services. All homes and on-shore fish processors are served by the City's piped water system. All on-shore processors generate their own electrical power. Unalaska school enrollment has decreased by 13.1% since 2008,[4] and 6.1% between 2019 and 2020,[4] likely as a result of the COVID pandemic.



Current Economy

Unalaska's economy is based on commercial fishing, fish processing, and fleet services, such as maintenance, trade, repairs, fuel, and transportation. Processors provide employment, and seasonal workers are brought in during peak seasons. In 2021, Unalaska generated $13,290,654 in total fishery related taxes (including shared and municipal).[5]

The overall amount of total fish taxes reported in 2021 increased by 0.2% since 2019.[5] These revenues support basic city services such as education, sanitation, transportation, etc. and are important indicators of community health and wellbeing. In 2020, per capita income in Unalaska was estimated to be $44,179[6] (down 18% since 2018), and the median household income was estimated to be $90,9381 (less than 1% since 2018)[6]. The percentage people living below the poverty line also decreased by 4% since 2018.[6]

Climate Change Vulnerability and Adaptive Capacity

Exposure to Biophysical Effects of Climate Change

A community's exposure to the biophysical effects of climate change, which include effects to the biological organisms and physical landscape surrounding them, aids in determining their vulnerability. The Aleutian islands are expected to experience increased temperatures and precipitation, and increased summer storminess. Similar to other Alaskan communities, they will be impacted by reduced sea ice as well.[7] In 2021, the Aleutians experienced an uncharacteristically warm winter and Unalaska had its rainiest February on record. These trends mirror those that are predicted for the region.[8] However, in comparison to other Alaskan communities, Unalaska has **a low risk of exposure to the biophysical effects of climate change.**

Dependence on Fisheries by Climate Change

Reliance on fisheries resources which are being impacted by climate change can determine how vulnerable a community is to disruption from climate change. Unalaska has high engagement with processing in both the groundfish and crab fisheries, Residents are also highly engaged in subsistence fishing of various species of groundfish and crab as well, with most households utilizing at least some subsistence fisheries resources. Overall, Unalaska is **highly dependent on fisheries resources** which will be impacted by climate change**.** As abundance and location of species continue to shift, Unalaska residents will likely be severely impacted by these shifts and any commensurate fisheries closures.

Recently, Unalaska island has been impacted by several subsistence salmon closures.[9] The Aleutian islands also have a history of being impacted by overexploitation of natural resources on which they depend for subsistence and other uses, specifically sea otters and Stellar sea lions.[10]

Local Adaptive Capacity

Unalaska has **high limitations on its adaptive capacity.** This rating takes into account factors in the community which can make it harder to adapt when disruptions occur. Sitka received a medium rating due to moderate vulnerability of its housing and infrastructure and various characteristics of its population, such as age, income level, economic diversity, education, and population composition.

*Social Indicators for Fishing Communities**

Labor Force:	Low
Housing Characteristics:	Low
Poverty:	Low
Population Composition:	Med-High
Personal Disruption:	Low

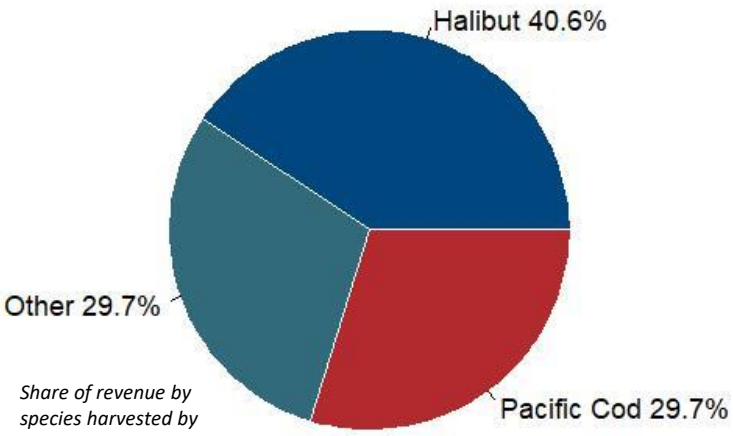
*Climate Change Vulnerability Ratings***

Exposure to Biophysical Effects:	Low
Fisheries Resource Dependence:	High
Limitations on Adaptive Capacity:	High

*Source: NOAA Fisheries Office of Science and Technology. 2019. NOAA Fisheries Community Social Vulnerability Indicators (CSVIs). Version 3 (Last updated December 21, 2020). https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-fishing-communities-0

**Source: Himes-Cornell, A., & Kasperski, S. (2015). Assessing climate change vulnerability in Alaska's fishing communities. Fisheries Research, 162, 1–11. https://doi.org/10.1016/j.fishres.2014.09.010

Share of landed revenue by species for resident owned vessels Unalaska 2017-2021 average

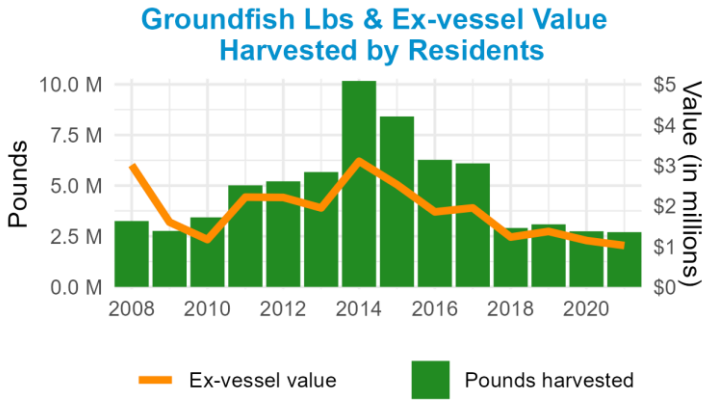


Share of revenue by species harvested by resident vessel owners or permit holders (2017-2021 average)

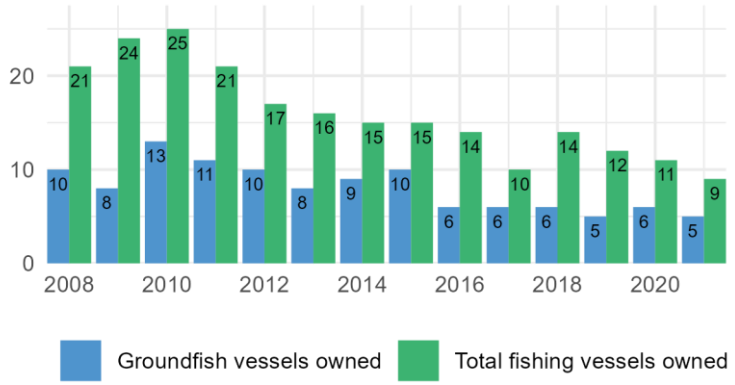
GF Harvesting Engagement LOW

Unalaska participates in a broad suit of fisheries: over the last five years, halibut has accounted for an average of 40.6% of the community's harvest, Pacific cod 29.7%, and other fish 29.7%. In 2021, Unalaska harvested 2.7 million pounds of groundfish with an associate value of $1 million. This marks a slight decrease from 2019: both volume and value harvested decreased by 384,959 pounds (12%) and $348,173 (25%) respectively. Overall, volume and value have steadily decreased since a peak in 2014, but have remained at a relatively constant level since 2018.

The number of groundfish vessels owned by Unalaska residents has held steady at 5 since 2019. The total number of fishing vessels in Unalaska has decreased from 12 to 9.



Vessel Ownership Among Residents



Crab Harvesting Engagement LOW

There is not a substantial amount of groundfish harvesting activity in Unalaska to report.

Due to confidentiality concerns, only select data are available.

Subsistence Harvesting Engagement

Residents of Unalaska are almost universally engaged in subsistence fishing, with 96.8% of all households utilizing fisheries resources (according to the most recent data available).[12,] The most common species include salmon, halibut, crabs (King crab, Tanner crab and Dungeness crab), cod, and rockfish. The high per capita harvest rates of both groundfish and crab indicate that residents of Unalaska rely on these species as key sources of nutrition in their diets.

According to more recent data on their halibut and salmon subsistence harvesting practices from the Alaska Dept. of Fish and Game, trends indicate that engagement in subsistence fishing for these two species has remained relatively constant in recent years, although declines in salmon harvests occurred starting in the year 2017.[12,13] Given that there have also been recent salmon subsistence fishing closures in the area, it is likely that these closures of declines in the salmon population more generally have impacted their ability to harvest as much as years past.[8]

Groundfish Subsistence
Unalaska (1994)*

55.2%
Households using at least one species**

35.2%
Households receiving at least one species**

26,664
Total pounds harvested

14.61
Pounds per capita harvested

Crab Subsistence
Unalaska (1994)*

82.5%
Households using at least one species**

79.2%
Households receiving at least one species**

40,296
Total pounds harvested

22.08
Pounds per capita harvested

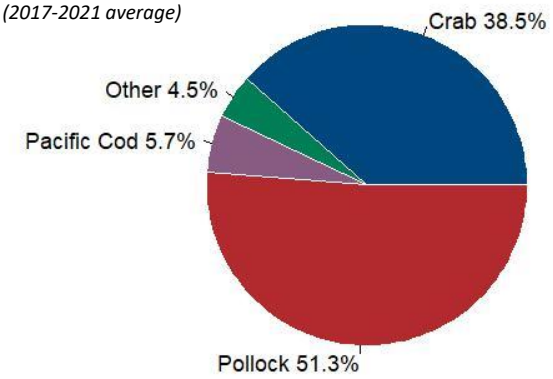
**Species include Cod, Walleye Pollock, Flounder, Greenling, Atka Mackerel, Lingcod, Rockfish, Sablefish, Sculpin, and Sole

**Species include Dungeness Crab, Tanner Crab, Hair Crab, King Crab, and Korean Horsehair Crab

*All subsistence information is from the Community Subsistence Information System (CSIS), ADFG. The CSIS is a repository of Alaska community harvest information gathered on the household level by ADFG, Division of Subsistence. This reflects the most recent data available. While some data are well in the past, they still reflect important information on subsistence activities within the community. These data will be updated as is available.

Share of revenue landed by species for Unalaska/Dutch Harbor *combined 2017-2021 average*

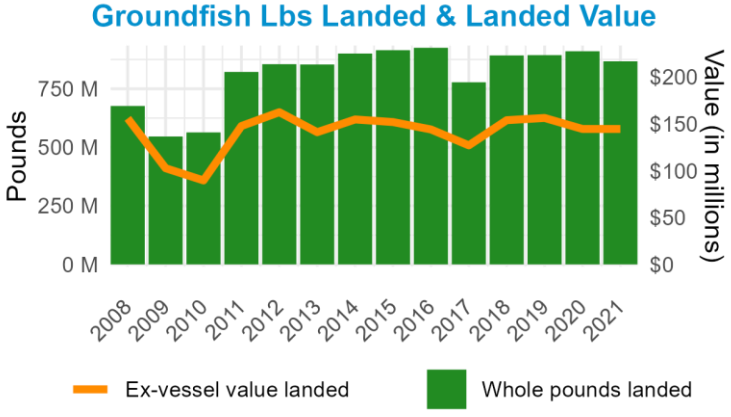
Share of revenue landed in community by species (2017-2021 average)



GF Processing Engagement *HIGH*

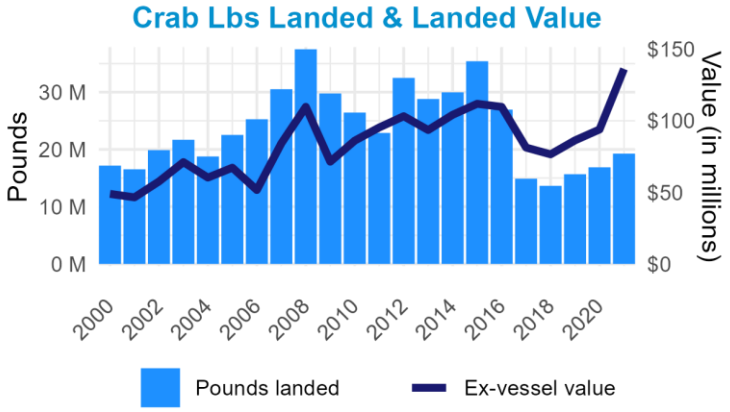
Although the majority of Unalaska residents depend on income derived directly from the commercial fishing and fish processing industry, few residents have ownership interest in major seafood related firms. Many of the largest shoreside fish processors are wholly- or partially-owned by Japanese interests. Many other large processor vessels (motherships), or floating processors are owned by non-Alaskan firms,[5] although CDQ groups have some ownership interests as well.

Unalaska has a total of 12 seafood processing plants, five of which process groundfish. The vast majority of landings in Unalaska over the last five years is Pollock at 51.3%.; Pacific cod accounts for about 5.7%, and crab 38.5%. In 2021, Unalaska processed 867 million pounds of groundfish with an associated landed value of $144 million. This is a 2.9% decrease in volume from 2019 (down 26 million pounds) as well as a decrease in landed value (down $11 million or 7.5%).

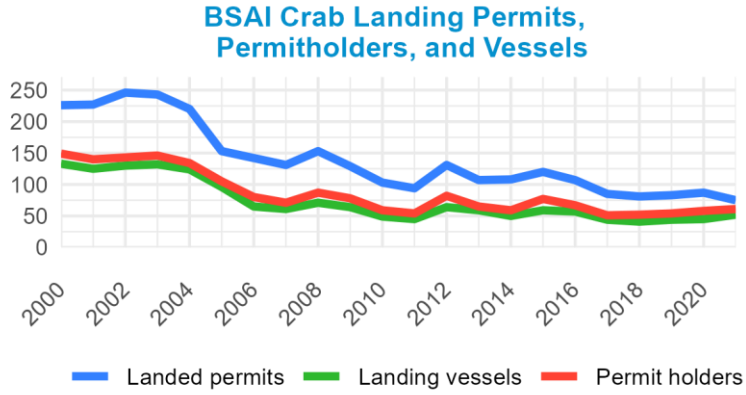


Crab Processing Engagement *HIGH*

Unalaska is highly engaged in the crab processing sector. The number of processing facilities in the region has increased since 2019 from 7 to 12. In 2021, Unalaska processed 19.2 million pounds crab with an associated value of $136 million. This marks a 22% increase (3.5 million pounds) in volume landed since 2019, and a 57% increase in landed value (up $49.9 million). The amount of BSAI crab processed in the region reached a peak of 35.4 million pounds (with a value of $112 million) in 2015, then began a steep decline. However, it has begun increasing again since 2019.



The number of permit holders increased from 54 in 2019 to 61 in 2020, as did the number of landing vessels (from 44 to 52). However, landing permits decreased during that time from 83 to 75. These numbers have been steadily declining since their peak in 2002-2003.



*Permits counted are CFEC gear operator permits

Fishing Community: A community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community.

Wellbeing: A state of being with others and the environment, which arises when human needs are met, when individuals and communities can act meaningfully to pursue their goals, and when individuals and communities enjoy a satisfactory quality of life. Includes many interrelated dimensions including physical, psychological, social, cultural, economic and governance. (Biedenweg et al. 2016; Breslow et al. 2016)

Food Security: When all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences in order to lead a healthy and active life

Food Sovereignty: The right of Peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems.

Engagement: A relative measure of community participation in fisheries based on four indices developed for this report including commercial harvesting engagement, commercial processing engagement, the processing regional quotient, and the harvesting regional quotient.

Reliance: A relative measure of to what extent a community's economy is dependent on participation in a particular fishery, taking into account factors such as value of landings per capita, number of commercial or recreational permits per capita, and percentage of residents who are employed in the industry.

Vulnerability: The degree to which a community is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. (IPCC, 2022)

Adaptive Capacity: the potential or ability of a community to adapt to the effects or impacts of climate change. (IPCC, 2022)

Pg. 4

[1] Electronic Code of Federal Regulations (CFR) Title 50, Chapter VI, Part 600, Subpart D, Section 600.345 (cited as 50 CFR 600.345)

[2] MSFCMA, § 600.345 National Standard 8—Communities.

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