Economic and Community Impacts of Salmon Fishing

Salmon fishing in Cook Inlet has an extensive economic footprint. This footprint has been characterized for commercial fishing on the Kenai Peninsula (www.ucida.org/fishing-documents-reports/economics/) and sportfishing in the Matanuska-Susitna Borough (see section on fisheries reports and studies: www.matsugov.us/boards/fishcommission) through various studies and analyses. In this section we focus on fishery measures that are relevant to understanding the social, economic, and community level landscape associated with the Cook Inlet drift gillnet fishery. Thus we examine the vessel, fleet, and processor level gross earnings and permit values. We also examine employment and tax contributions to different communities as available. At the community level we explore how vulnerability indices can help us to understand the role that fishing and fishing incomes play on Kenai communities as a whole. Data collection has varied over time and not all metrics have been recorded consistently so the time periods presented in some figures vary. As discussed elsewhere in this discussion paper, challenges arise in segregating aspects of this economic landscape between fish obtained from, or fishing activities occurring in, the EEZ versus State waters of Cook Inlet. Thus, all reported values in this section aggregate S03H fishing activities and present total values without differentiating EEZ and state waters catches.

For analytical purposes, it is convenient to divide the EEZ salmon fishery contributions to regional employment and income into *direct*, *indirect*, and *induced effects*.

> Direct effects direct effects are those reflected in jobs and income directly attributable to participation in the fisheries. In this case, these include the direct employment of the crew of the salmon trollers, gillnetters, and seiners and direct income to various participants in the fishing firms (crew shares, vessel shares, or shares for Alaska limited entry permit holders).
>
> Indirect effects are those generated in other businesses, by the purchases or sales of the salmon fishing firms. Indirect effects would accrue to businesses supplying fuel and supplies, fishing gear and fishing gear repairs, ship construction and repairs, insurance, banking, legal, and accounting services, lobbying, and consulting. The goods and services above are "backward" linkages. Jobs and income may also be associated with "forward" linkages, in processing firms, and in firms providing transportation, warehousing, cold storage, brokering, and other distribution services.
>
> Induced effects are those generated when directly or indirectly employed persons spend their income. Employment and income are created when people receiving income from fisheries spend their money on such things as groceries, gas, cars, car repairs, rent, home repairs, home construction, insurance, and so on.

It is customary to think of these regional economic contributions in terms of *multipliers* showing the total indirect and induced employment and income associated with direct employment and income. Multiplier estimates depend in part on the size of the community under consideration, because the smaller the community, the greater the "leakage," as more labor, goods, and services are purchased outside of the community.

> Multipliers for fishing activity within Alaska tend to be relatively low, compared to those for other Alaskan industries. Significant portions of the management and labor in fisheries and fish processing, tend to originate outside of the state. Significant portions of productive inputs tend to be purchased outside of the state (see Seung's analysis of Alaska seafood processing, Seung 2008: 102). Because of this, direct, indirect, and induced effects tend to be divided between Alaska, and the places of origin for these inputs.

4.3 Harvests of salmon in Cook Inlet

Salmon is commercially harvested in Cook Inlet by drift gillnet, set net, and purse seine gear, which land a combined average of 31.3 million pounds of salmon annually, valued on average at 50.1 million USD annually (Figure AA). At the level of individual permit holders, the average annual earnings from 1975-2018 is about 80,000 USD, 51,000 USD, and 32,000 USD for the purse seine, drift gillnet, and set net sectors, respectively (Figure BB). In the late 1990s salmon prices dropped precipitously and statewide landings and fishery earnings declined in concert. Prior to this decline, average annual permit-level earnings (1975-1999) were higher for the drift gillnet and set net (about 67,500 USD and 41,000, respectively). From 2000 - 2018 however, average annual permit-level earnings dropped to 30,000 USD and 22,000 USD for the drift gillnet and set net sectors, respectively. For the purse seine fleet, the average permit-level earnings have increased from a pre-2000 average of about 72,000 USD to an annual average since 2000 of about 92,000 USD (though the number of participants is now about 25% of its earlier number). All numbers reported here are adjusted for inflation and omit 1989, during which time the drift gillnet fishery was largely closed due to the Exxon Valdez Oil Spill.

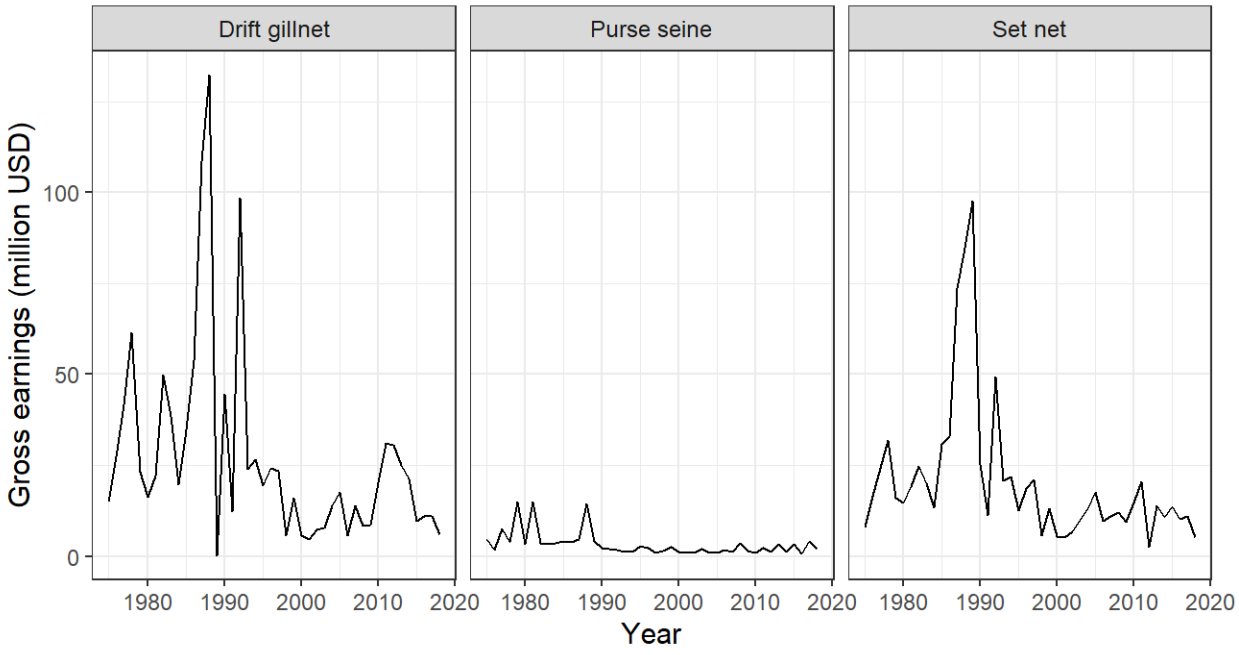


Figure AA. Total annual earnings (inflation adjusted) for the drift gillnet (permit S03H), purse seine (permit S01H), and set net (permit S04H) fleets in Cook Inlet from 1975 - 2018.

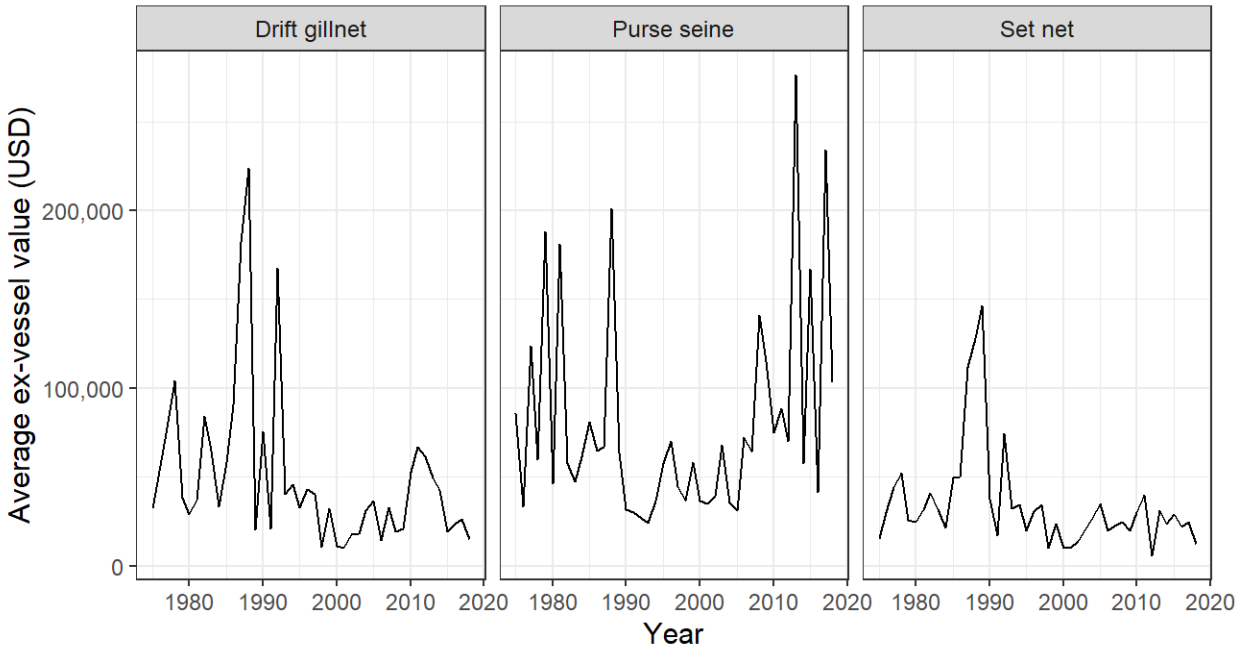


Figure BB. Average annual earnings per permit holder (referred to as ex-vessel, as it is typically calculated) for the drift gillnet (permit S03H), purse seine (permit S01H), and set net (permit S04H) fleets in Cook Inlet from 1975 - 2018.

Table 1.1 highlights earnings from salmon commercially harvested using drift gillnet gear in the Central District of UCI. In 2016, the estimated gross earnings from salmon (all species) harvested using drift gillnet gear were $12.3 million, which represents 51.6 percent of the total earnings grossed by all commercial fisheries (purse seine, set gillnet, and drift gillnet combined) throughout Cook Inlet. Between 1997 and 2016, earnings from salmon commercially harvested using drift gillnet gear in the Central District represented at the maximum (2012) 89.3 percent of the total all-gear gross earnings, and at the minimum (2006) 33.7 percent of the total all-gear gross earnings. On average, from 1991 to 2010, earnings from salmon commercially harvested by drift gillnet gear in the Central District were 53.0 percent of the total Cook Inlet all-gear gross earnings.

Table 1.1. Central District (Upper Cook Inlet) drift gillnet participation and estimated gross earnings from commercially retained salmon (all species) compared to total Cook Inlet estimated gross earnings across all salmon permit types, 1997-2016.

	Central District drift gillnet commercial salmon harvests						Estimated gross earnings by all permit types in Central District	Total Cook Inlet estimated gross earnings, all permit types	Central District drift gillnet earnings as pct. of total Cook Inlet earnings
Year	Number of salmon	Pounds of salmon	Estimated gross earnings	Avg. estimated earnings per permit	Permit count	Processor facility/platform count			
1997	2,398,105	16,021,059	$17,448,194	$30,504	572	24	$31,592,156	$33,861,060	51.5%
1998	971,289	5,401,864	$4,296,966	$8,138	528	18	$7,732,908	$9,717,632	44.2%
1999	1,648,851	10,395,737	$12,134,809	$24,917	487	17	$20,878,866	$24,040,441	50.5%
2000	995,989	6,414,163	$4,438,593	$8,652	513	18	$7,753,849	$9,788,168	45.3%
2001	990,291	6,256,255	$3,711,269	$7,947	467	23	$7,217,029	$8,516,376	43.6%
2002	1,938,185	12,635,291	$5,686,012	$13,902	409	19	$10,697,859	$12,057,334	47.2%
2003	1,780,707	10,891,761	$6,329,162	$15,142	418	21	$13,650,133	$15,979,498	39.6%
2004	3,097,739	19,335,647	$11,798,105	$26,814	440	23	$22,264,897	$23,639,876	49.9%
2005	2,717,322	17,141,891	$15,251,702	$32,382	471	27	$29,802,766	$31,442,246	48.5%
2006	1,157,744	6,124,173	$5,158,809	$13,027	396	28	$12,990,092	$15,313,750	33.7%
2007	2,073,769	13,409,028	$12,759,634	$30,599	417	27	$21,992,110	$24,071,974	53.0%
2008	1,222,270	7,574,575	$7,823,008	$18,364	426	27	$17,983,298	$22,643,337	34.5%
2009	1,265,009	7,755,827	$8,200,391	$20,298	404	28	$15,770,983	$18,588,144	44.1%
2010	2,078,153	12,897,283	$19,300,530	$51,060	378	26	$31,912,945	$34,470,900	56.0%
2011	3,363,839	21,982,454	$30,378,044	$65,753	462	25	$48,906,745	$52,571,823	57.8%
2012	3,561,850	23,684,009	$30,546,478	$61,586	496	21	$32,091,929	$34,206,521	89.3%
2013	2,006,959	13,040,140	$25,230,345	$50,868	496	27	$37,655,449	$42,862,831	58.9%
2014	2,099,996	12,638,888	$21,897,306	$44,148	496	26	$31,235,697	$34,173,535	64.1%
2015	1,412,523	8,128,669	$9,917,636	$20,158	492	33	$22,067,207	$27,123,331	36.6%
2016	1,734,190	9,878,434	$12,279,641	$26,239	468	27	$21,869,678	$23,781,294	51.6%

Note: Only commercially retained harvest is included. Earnings estimates and average earnings estimates are based on CFEC gross earnings data. Central District drift gillnet harvest reflects harvest recorded in Central District ADF&G salmon statistical areas by vessels fishing with Cook Inlet salmon drift gillnet (S03H) permits. Total Cook Inlet harvest is associated with the following CFEC permit types: Cook Inlet salmon purse seine (S01H), Cook Inlet salmon drift gillnet (S03H), and Cook Inlet salmon set gillnet (S04H). Cook Inlet salmon special harvest area (S77H permits are not included. Earnings estimates and average earnings estimates per permit are based on CFEC gross earnings data.

Within the salmon fleet, the drift gillnet sector accounts for about half of the earnings and pounds landed annually. On average about 70.5% of the pounds landed by this sector are sockeye salmon, which account for 84.2% of the average ex-vessel value.

4.4 Magnitude of Federal Harvest

As noted previously, because this fishery management plan proposes amendments relevant to the EEZ portion of the fishery only, it is necessary to examine the distribution of catches to state and EEZ waters separately. ADF&G staff explored potential harvest ratios between state and federal waters based on fish ticket data for salmon harvest among ADF&G subdistricts (Figure CC).

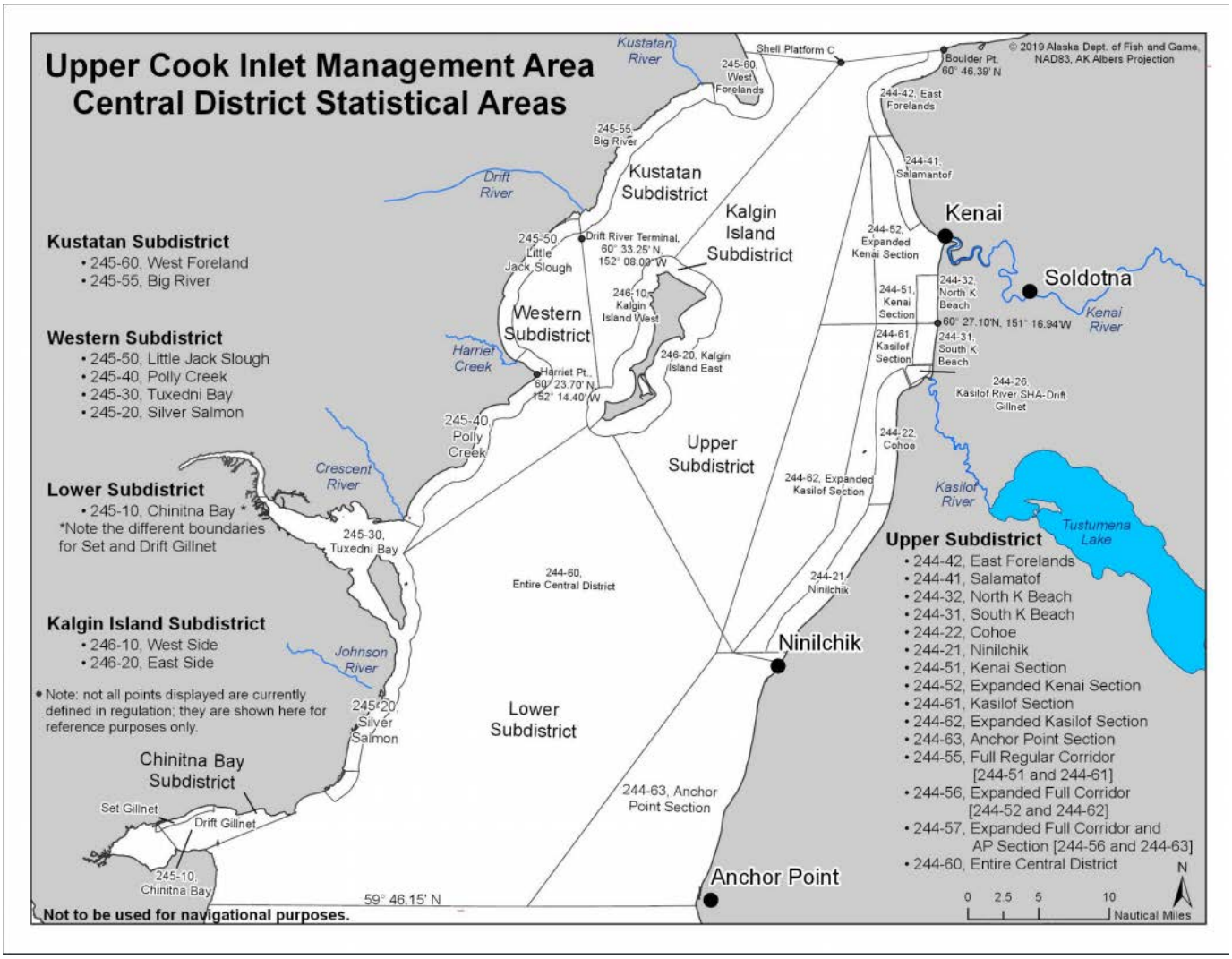


Figure CC. Map of the Cook Inlet salmon fishing subdistricts.

Fish tickets are completed at the time of delivery as a condition of limited-entry permit fishing in State-managed commercial fisheries. Required information includes “area caught” (nearest bay or headland) and statistical area(s) including % in numbers of fish per statistical area for salmon fisheries. ADF&G biologists examined fish ticket data from 2007-2016 (10 years) for the Upper Cook Inlet (UCI) salmon drift fleet. Harvests were sorted into combinations of statistical area

and locale code, where the locale code (explained in Table 1.3) was taken from "area caught" on the fish tickets and correspond to areas in UCI that State managers open and close as part of in-season management (Figure EE). State:Fed harvest ratios were estimated based on statistical area/locale code and how they overlapped with the EEZ.

The Central District of UCI includes all waters north of the latitude of Anchor Point and south of a line from Boulder Point to Shell Platform C to the western shore. When drift gillnetting is open in all of these waters, it is often called a district-wide opening. Often times, however, in an attempt to target harvest on a specific stock or to limit harvest of a particular stock, only parts of the Central District are open to drift gillnet fishing. The Alaska Board of Fisheries has designated these areas as Drift Gillnet Areas 1-4 (Figure x). To help track harvest from these sub-areas, they are assigned a locale code (Table DD) on fish tickets, which is different than a statistical area. Because the boundaries of EEZ waters are not completely located with a single or multiple statistical areas, nor do they match up with the boundaries of the sub-areas assigned locale codes, the percentage of harvest that occurs in these areas that comes from EEZ waters versus State waters must be estimated (Table 1.2). From 2007-2016, the estimate of the number of sockeye salmon harvested by UCI drift gillnetters in EEZ waters versus State waters as a percentage of total harvest was approximately 50/50 (Table 1.3x).

Table 1.2 Drift gillnet sockeye salmon harvest by state statistical area, 2007 – 2016.

Drift Gillnet sockeye salmon harvest by stat area, 2007-2016

No. Fish	Stat Area	Locale Code	State	EEZ
1,863	24426	01	1,863	
62,930	24426		62,930	
186,211	24455		186,211	
4,032	24456	01	1,008	3,024
2,168,240	24456		2,168,240	
206	24457	01	52	155
1,112,440	24457		1,112,440	
7,337,740	24460	01	1,834,435	5,503,305
8,645	24460	04	6,484	2,161
831,730	24460	05	415,865	415,865
5,016,262	24460	DW	2,508,131	2,508,131
200,236	24461		200,236	
12	24510	04	12	
817	24510		817	
		Totals =	8,498,723	8,429,462
			50%	50%

Table 1.3 Drift gillnet area locale names (top) and assumed State/Fed harvest ratios..

Locale Code	Place Name	Area
1	Drift Area 1	244-60
2	Drift Area 2	244-60
3	Drift Area 3	244-60
4	Drift Area 3 & 4	244-60
5	Drift Area 1 & 2	244-60

Explanation of Major Harvest Assumptions

District Wide harvest is 50/50 State vs. EEZ
Drift Area 1 harvest is 25/75 State vs. EEZ
Drift Area 1/2 harvest is 50/50 State vs. EEZ
Drift Area 3/4 harvest is 75/25 State vs. EEZ

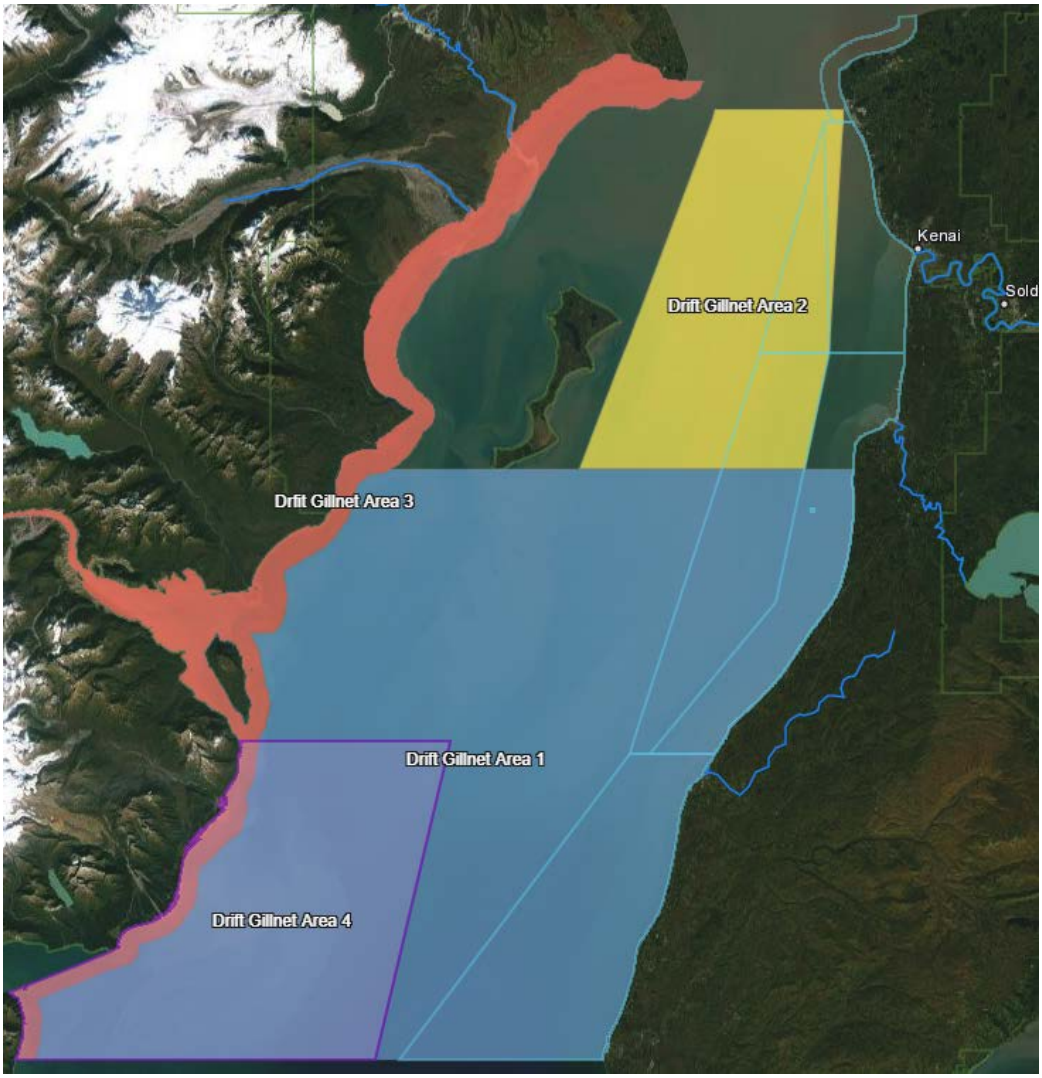


Figure DD. four different drift gillnet fishing areas that are assigned locale codes on fish tickets that allow for distinct area harvest determination.

4.5 Fishing Permit Values

In Alaska salmon fisheries the value of CFEC limited entry permits provides an index of fishery economic condition. Similar to other Alaska salmon fisheries, S03H (Cook Inlet Salmon Drift Gillnet) permit value experienced a sharp rise in value in the late 1980s through the early 1990s concomitant with high salmon ex-vessel prices and earnings (Figure EE). Beginning in the 1990s and continuing into the early 2000s the price of Alaska salmon dropped across the state, in part because of the large output of farmed Atlantic salmon and a shift in global salmon markets. The S03H permit had an inflation adjusted apex value of $317,337 in 1990 and reached a nadir in 2002 at $14,435. While S03H permit value has increased since the early 2000s rising to $81,668 in 2013, permit prices have since fallen to $36,136 in 2018 (as noted previously, inflation adjustments were done to a base year of 2012 so values since 2012 will appear less than the nominal values reported by CFEC).

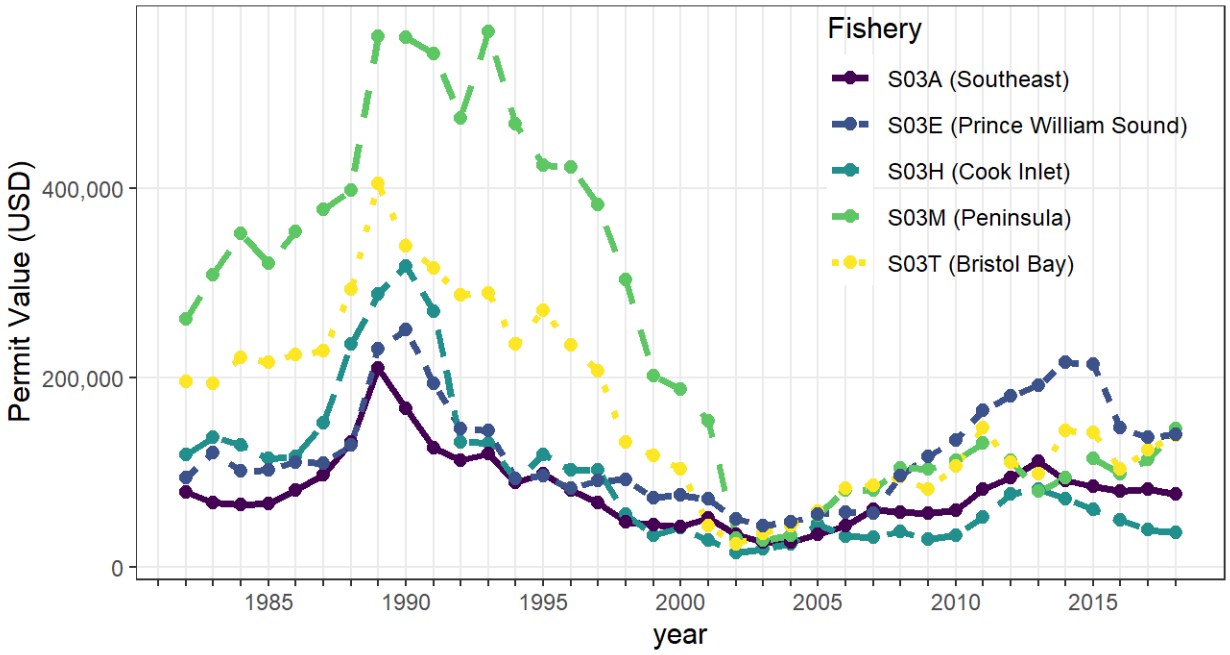


Figure EE. Value (inflation adjusted) of gillnet permits for Southeast, Prince William Sound, Cook Inlet, Alaska Peninsula, and Bristol Bay, 1982 through 2018 (Source CFEC)

A valuable context for trends in permit prices relative to this fishery management plan is to examine how the Cook Inlet permit prices compare to drift gillnet permits throughout the State. In Figure EE (above), the other four Alaska drift gillnet permits were revealed similar trends with respect to a nadir in the early 2000s. An alternative method for exploring trends of different data series is to standardize each trend relative to that trend's average value (Figure FF). In such a standardized, or anomaly, plot the trends can be compared to each other. Throughout most of the 1980s and early 1990s, drift gillnet permit prices were above average (bars appear above zero) before falling below average (bars below zero) from the late 1980s through about 2010. Since 2010, Prince William Sound and Southeast Alaska permit prices have rebounded to above their long-term average while Cook Inlet, Bristol Bay, and the Alaska Peninsula permits have remained below average. For the last few years, Southeast Alaska permits have hovered around their long-term average. Permit prices are often lagged 1-2 years behind fishery performance.

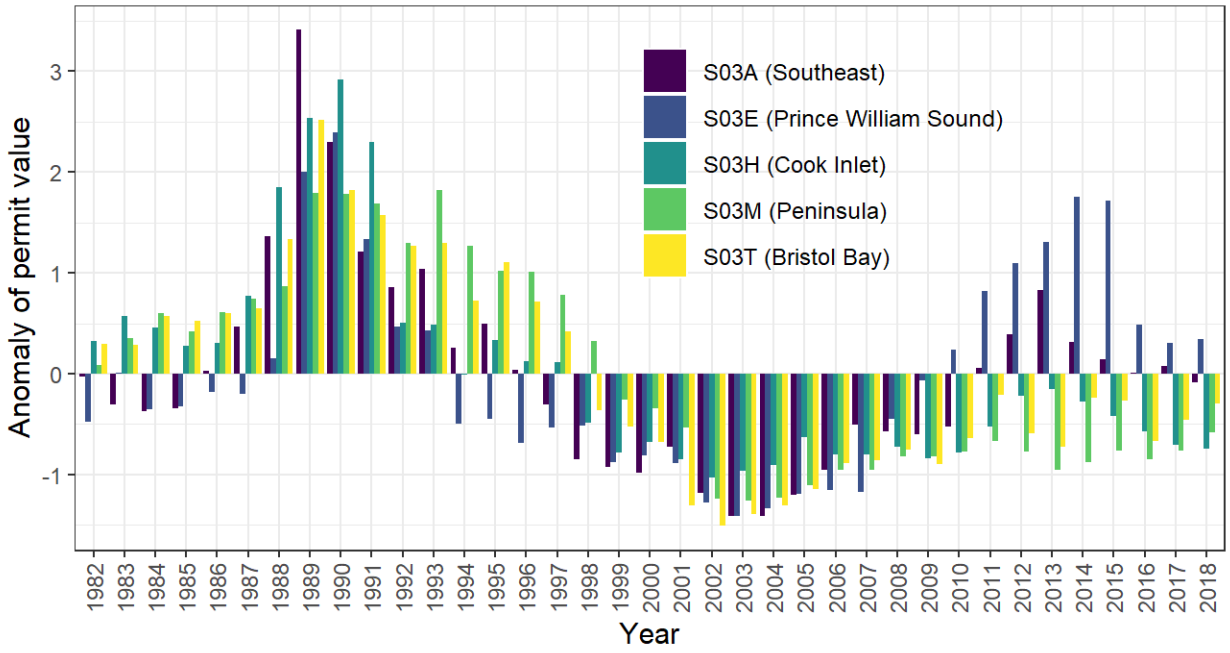


Figure FF. Permit value anomalies for gillnet fisheries. While permit values vary across fishery, this type of illustration facilitates a comparison of trends over time relative to the average for each fishery. Each color represents a fishery and bars illustrate how permit values for each fishery and year compare to the average permit value for that fishery over time. A bar at zero on the y-axis would represent the average. Bars below zero represent below average permit values. Bars above zero represent above average permit values. For example, in 2016, Cook Inlet, Peninsula, and Bristol Bay had permit values below their long term average, while Southeast permit values were above average, and PWS permits were average value.

4.6 Employment

The direct employment contribution of EEZ fishing activity is the employment of persons on the fishing vessels. The Alaska Department of Labor (ADOL) surveys permit holders in Alaska's fisheries and uses the responses to estimate crew factors in Alaska's commercial fisheries. The crew factor for a fishery is equal to the estimated average size of vessel crews in the fishery, excluding the skipper. Using the ADOL crew factor estimates from its 2010 survey, and adjusting them to account for skippers, it is possible to estimate the number of separate job positions available in fisheries in a year. This is done by assuming that each permit fished corresponds to a separate fishing operation, incrementing the ADOL crew factor for the fishery by one, to account for the skipper, and multiplying the number of permits fished by the adjusted crew factor. The number of separate persons active is likely to be larger, due to turnover in positions. The survey does not collect information about the place of residence of crewmembers.

It is not possible to estimate the numbers of permit holders active *only* in the EEZ. Thus, the Cook Inlet positions, reported below (Table 1.5), correspond to the numbers of permits fished in the relevant districts from **Table 1.1** and may overstate the number of positions attributable to salmon fishing in the EEZ.

In treating the number of permits fished from 1997 to 2016 as a guide to the distribution of permits normally fished, and multiplying the number of permits fished by the estimated average vessel crew size, the median number of positions active in Cook Inlet District would be 1,075. As noted, the estimates for the Cook Inlet are not EEZ-specific, but also cover any vessels that fished in the district.

Table 1.4 Crew size estimates for the Cook Inlet drift gillnet fishery from 1997 through 2016 (source: ADOL).

Year	Cook Inlet Drift Gillnet Crew Estimate
1997	1,316
1998	1,214
1999	1,120
2000	1,180
2001	1,074
2002	941
2003	961
2004	1,012
2005	1,083
2006	911
2007	959
2008	980
2009	929
2010	869
2011	1,063
2012	1,141
2013	1,141
2014	1,141
2015	1,132
2016	1,076
Median	**1,075**
Mean	**1,062**

An additional component of estimating employment in the Cook Inlet fishery is dual permit operations, in which a single vessel may be operating with multiple permit holders. Because a permit substitutes for a crew license, those vessels operating with dual permits may not have official crew aboard. Additionally, while we do not attempt to estimate fishing costs or net revenues, those vessels operating under dual permit scenarios also change the relative ratios between gross and net revenues.

Alaska residents are found in smaller proportions in the seafood processing sector than in the fishing sector. The Alaska Department of Labor (ADOL) estimates seafood processing workforce participation by residency. In Southcentral Alaska, From a statewide perspective, ADOL estimates that 23.0% of processing jobs are held by local (Southcentral Alaska) residents while 69.4% of processing jobs are held by non-Alaska residents (average 2010-2015; live.laborstats.alaska.gov/seafood/Southcentral/SCLngvtyRes.pdf). 28.5% of the seafood processing workforce are Alaska residents and 71.5% are non-residents.

Seung and Waters (2006) report that the seafood processing industry's output multiplier is among the lowest for Alaska industries, because much of the income earned in the industry is earned by non-residents, and because a large proportion of intermediate inputs are purchased from out of state. They

estimate that about 60 percent of labor earnings in seafood processing leave Alaska, and that about 69 percent of intermediate inputs is imported (Seung and Waters 2006: 347-348).

4.7 Fisheries Taxes

Alaska's fisheries taxes, some of which are shared with communities or enhancement operations local to fisheries, are another source of indirect salmon fishery effect. "Fish" tax receipts shared with a community may be associated with increased community spending on goods and services within the community, smaller community sales tax or property tax assessments, purchases of goods and services outside the community, or some combination of these. Costs recovered for salmon aquaculture may be a source of local employment and income, as well.

The salmon fisheries that occur, in part, in the waters of the EEZ may be subject to different combinations of five separate State fisheries taxes. These are listed in **Table 1.6**. The taxes and rates applicable to the salmon fisheries in the EEZ are:

- Fisheries Business Tax: The fisheries business tax is generally paid by the first processor of processed fish, or the exporter of unprocessed fish, based on the ex-vessel price of unprocessed fish. The rates vary depending on the type of processor, and on whether or not the species of fish is considered a "developing" species. Salmon species are considered established species. The key applicable rates for the species of salmon considered here are those for shore-based processors and direct marketers (3 percent), floating processors (5 percent), or salmon canneries (4.5 percent). Half the tax revenues are shared with communities where the processing takes place. Revenue sharing is based on fishery harvests one year before, thus this tax is calculated and distributed to the municipalities in 2017 for fishing that took place in 2016.

- Fishery Resource Landing Tax: This tax is levied on fishery resources processed outside the three-mile limit and first landed in Alaska, or on fish processed subject to section 210(f) of the American Fisheries Act. The tax is levied on the average unprocessed value of the fish. This tax would not be levied on drift gill net vessels or seine vessels, which do not process salmon on-board.

- Seafood Marketing Assessment: Any person processing or exporting more than $50,000 of seafood products in a calendar year is responsible for paying 0.5 percent of the ex-vessel value of the fish to support marketing efforts. This revenue is not shared with communities affected by the fisheries.

- Salmon Enhancement Tax. Salmon fishermen in a region may vote to assess themselves to support salmon enhancement programs in their regions. Assessments may vary from program to program. Assessments are collected by licensed fish buyers from limited entry permit holders when they sell their salmon. Limited entry permit holders who sell to unlicensed buyers or export their fish from the aquaculture region where they were caught must pay the assessment themselves. These revenues support salmon enhancement activity in the regions within which they are collected.

Regional Seafood Development Tax: Groups of Alaska fishermen may organize to form regional fisheries development associations for marketing, infrastructure, or other development purposes. Fishermen may vote to assess themselves to fund these activities. Among the groups of salmon fishermen operating at times in the EEZ, only the Prince William Sound drift gill net fishermen have voted to assess themselves for this purpose; these voted to assess 1 percent of their gross revenues.

Table 1.6 Summary of State of Alaska fisheries taxes. Salmon from the EEZ make a contribution to state tax revenues. (Source ADOR)

	Fisheries Business Tax	Fishery Resource Landing Tax	Seafood Marketing Assessment	Salmon Enhancement Tax	Regional Seafood Development Tax
Cook Inlet drift gillnet	3.0%, 4.5%, or 5% depending on processor type	0.0%	0.5%	2.0%	0.0%
Statute	AS 43.75	AS 43.77	AS 16.51	AS 43.76.001	AS 43.76.350
Regulations	15 AAC 75	15 AAC 77	15 AAC 116	15 AAC 76	Not applicable

The tax reporting for municipalities is not broken down by the fishery or whether fish were caught in the EEZ or in State waters. Aggregate tax contributions from all fisheries include salmon caught in both federal and state waters. Among the primary fishing communities on the Kenai Peninsula, only Homer and Kenai had readily available fishery tax income data (Figure GG).

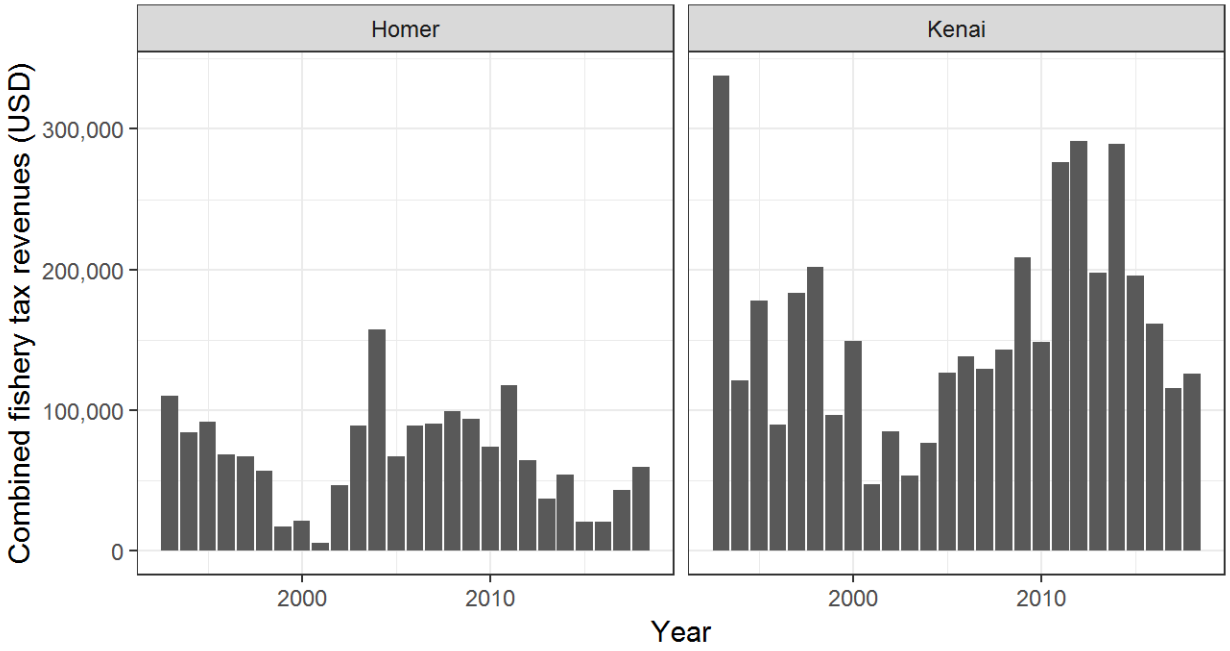


Figure GG. Combined tax revenues for Homer and Kenai. These revenues including landing and fishery business taxes and are inclusive of all species (i.e., salmon, halibut, etc.) landed.

4.8 Alaska and Southcentral Alaska Residency

The share of fishing activity conducted by Alaskan residents differs by fishery. The fisheries that are affected by this fishery management plan require limited entry permits issued by the State. Alaska tracks permit issuance; permits fished, and permit production and revenue by state of residence of the permit holder. The percentage of permits fished by Alaska residents varies by permit fishery. In the Cook Inlet drift gillnet fishery, an average of 70.7% of active permits (1975-2018; excluding 1989 when little fishing occurred) were fished by Alaskan residents (Figure HH) (source: CFEC 2019). Those Alaska residents

landed an average of 71.0% of the annual earnings over that same period, about 19.5 million USD (inflation adjusted) (Figure II).

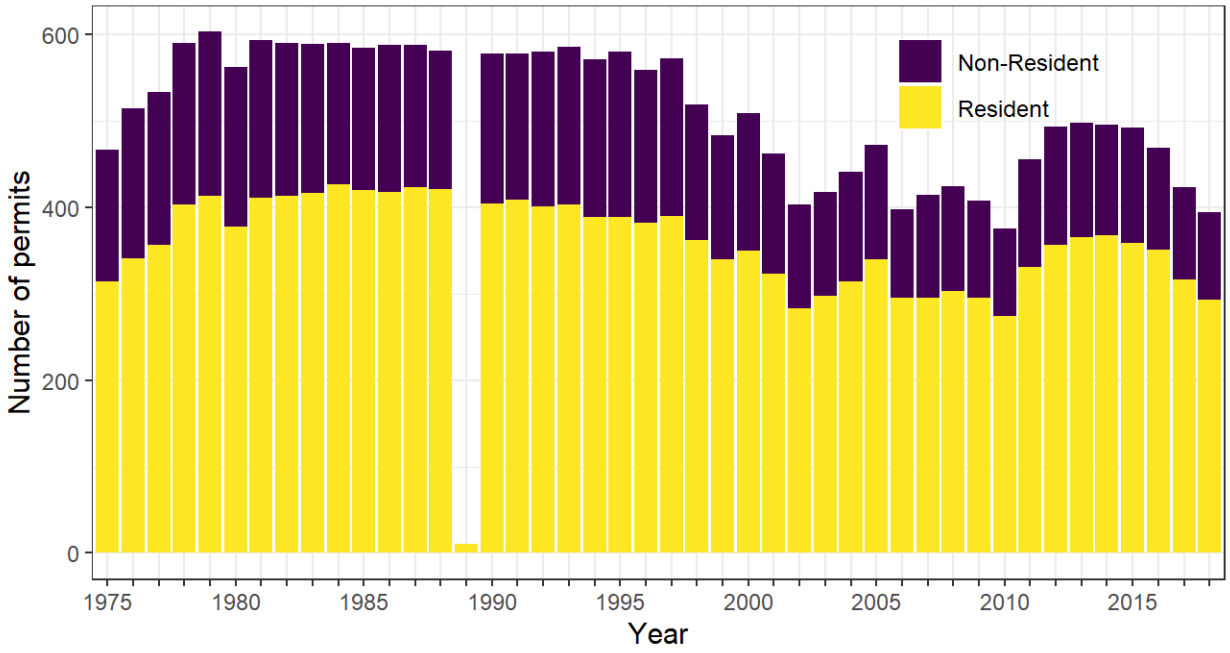


Figure HH. Proportional composition of active permits fished by Alaska and non-Alaska residents. The total height of bars equals the total number of permits fished in a year, while each of the colors represents the proportion of permits held by residents (yellow) and non-residents (purple). Missing data in 1989 are associated with closures resulting from the Exxon Valdez Oil Spill.

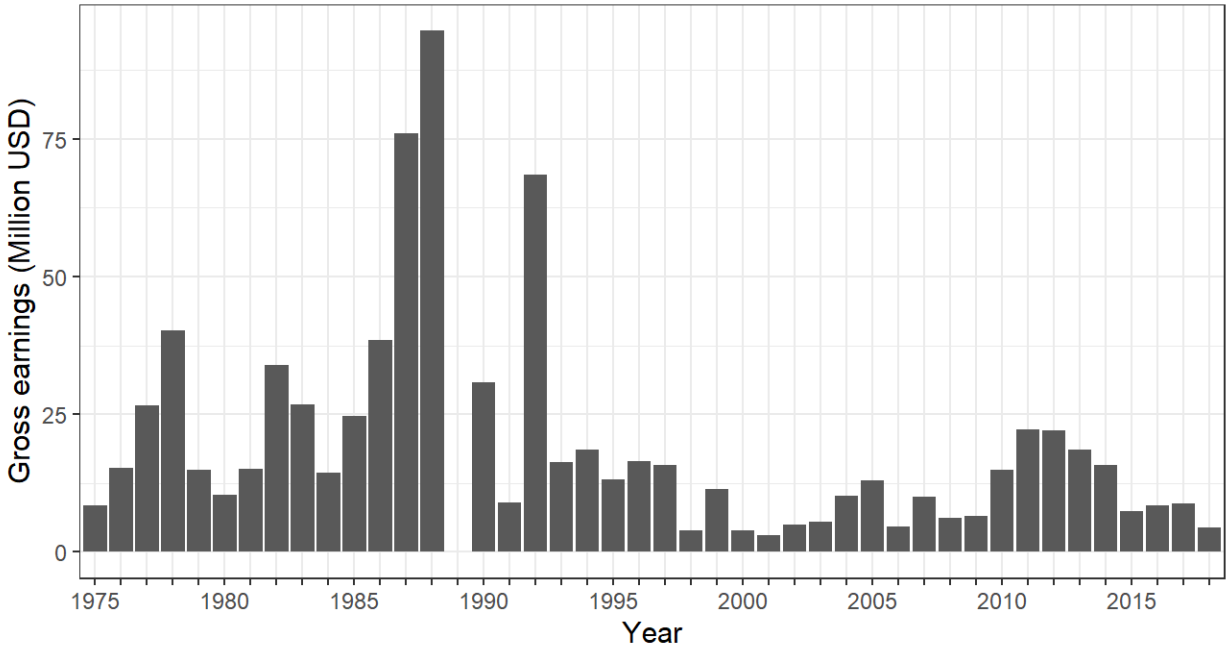


Figure II. Total gross annual earnings for Cook Inlet drift gillnet permits held by Alaskan residents from 1975-2018. Dollar values inflation adjusted to 2012. Missing data in 1989 are associated with closures resulting from the Exxon Valdez Oil Spill.

The majority of commercially retained salmon harvested using drift gillnet gear in the Central District of UCI is delivered to the port of Kenai. The average amount of salmon (all species combined) delivered to Kenai (from drift gillnet vessels fishing in the Central District) from 1992 - 2018 was 9,228,411 pounds with an average estimated gross ex-vessel value of $11,940,822 (Figure JJ). Salmon accounts for the majority of seafood processing in Kenai. Other ports taking deliveries of salmon in Cook Inlet include Nikishka/Nikiski, Homer, Kasilof, and Anchorage.

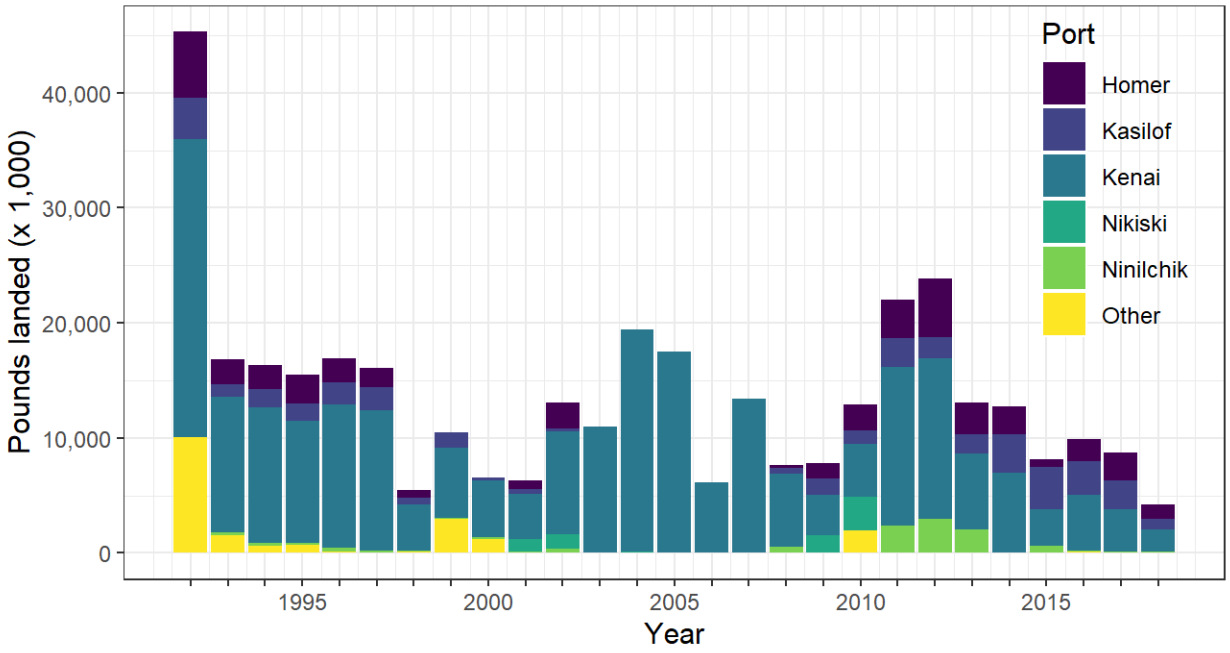


Figure (JJ). Pounds landed by port for the Cook Inlet drift gillnet fishery.

Homer is the primary community of residence for drift gillnet permit holders operating in Central District of UCI. For the time period 1997 through 2018, an average of 100 Homer drift gillnet permit holders were active in the Central District, with a combined annual average estimated gross earnings of $3,144,153 from harvests in the Central District. Other main Alaska communities of residence for drift gillnet permit holders operating in the Central District include Kenai, Soldotna, and Kasilof, and Anchorage ((Figure GG). Communities of residence outside of Alaska associated with this activity include Astoria, Oregon and Cathlamet, Washington.

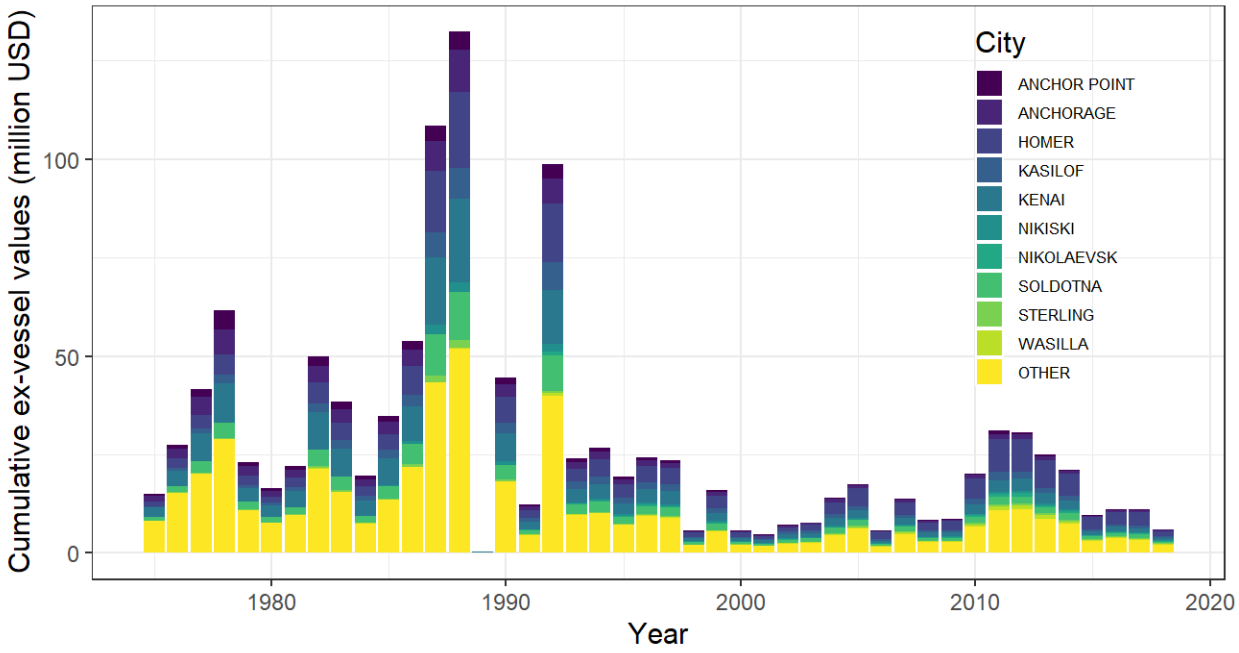


Figure GG. Cumulative ex-vessel revenues for the ten communities with the greatest number of S03H permit holders from 2013-2018. All other communities are combined into the "Other" category. Eight of the top ten earning communities are on the Kenai Peninsula.

On average, from 1975-2018, 61.1% of permit holders have resided in one of the top ten towns and they have accounted for an average of 62% of the annual landed value of the fishery. Figure HH shows a relatively stable relative participation (based on a permit being active in a season) by community (note again, that 1989 is anomalous due to the Exxon Valdez oil spill).

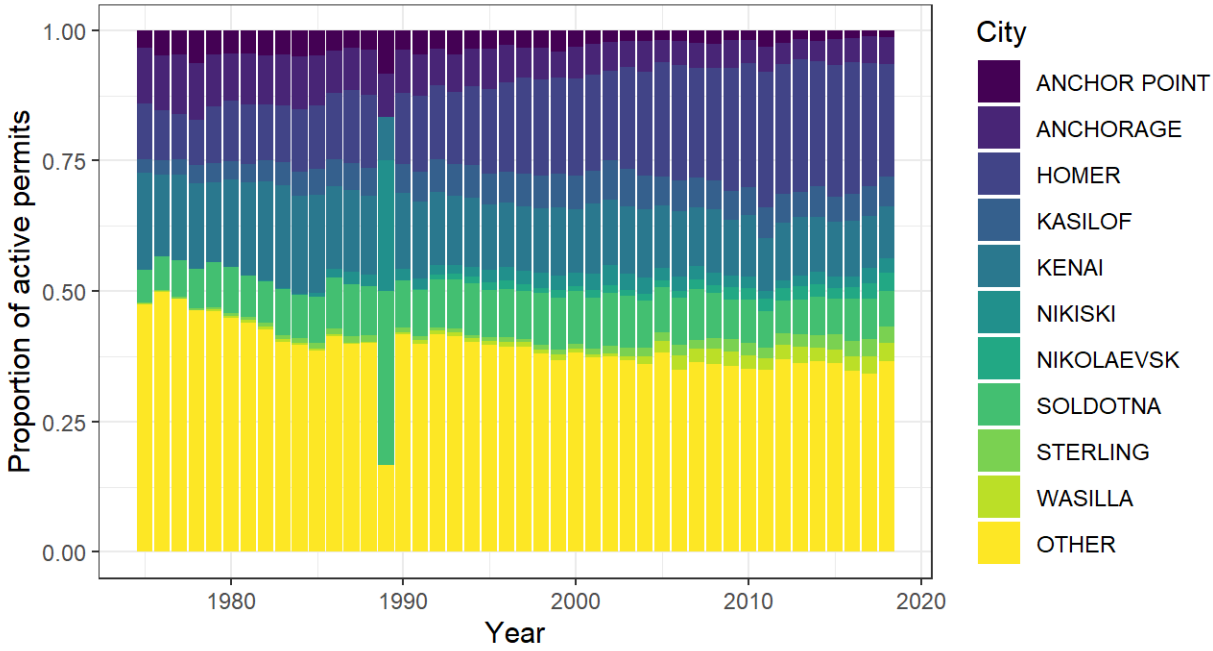


Figure HH. Proportion of permits fished in a given year by the community in which the permit is registered.

4.9 Community Fisheries Engagement Indices of the Cook Inlet Salmon Drift Gillnet Fishery

This analysis adapts a framework developed by the National Marine Fisheries Service (NMFS)to create quantitative indices of fisheries engagement to help understand community well-being and participation in marine fisheries.[1, 2] These performance metrics can be used to track fisheries participation over time using pre-existing data for all communities participating in commercial fisheries by examining the degree to which Alaska and non-Alaska communities participate in different aspects of commercial fisheries.[3] This analysis focuses specifically on those communities engaged in Cook Inlet salmon drift gillnet harvesting and processing activities. The purpose of this analysis is to explore the degree to which communities are engaged in Cook Inlet salmon drift gillnet harvesting and processing and how their participation has changed over time. These indices can be used to provide information about the degree to which communities have sustained participation in this fishery over time to support NMFS and NPMFC decision making processes as they relate to National Standard 8.[4]

4.9.1 Methods

4.9.1.1 Engagement Indices

Communities were included in the analysis based on the activity of vessels that are prosecuting the Cook Inlet salmon drift gillnet fishery over the period 1991-2017. This analysis considers two somewhat distinct aspects of community engagement in commercial fisheries in Alaska: **a) commercial processing engagement** reflects activities associated with vessel landings and actual fish deliveries in the community and associated processing employment, municipal tax revenues, demand for supplies, and profits; **b) commercial harvesting engagement** reflects activities associated with the community of residence of the vessel owners engaged in this fishery as that community also benefits from the fisheries activity and associated income including some portion of crew and other supplies will also be procured in this location. The communities that are highly engaged in processing in Alaska are not always the same as those engaged in the harvesting, and this analysis will consider these two aspects of engagement and their impacts separately.

All communities in Alaska with activities in these fisheries are included in the anslysis,[5] and non-Alaska communities are grouped into 5 groupings: the Seattle metropolitan statistical area (MSA), Other Washington, Oregon, California, and All Other States. Communities were included in the processing engagement analysis if any vessels using Cook Inlet Salmon drift gillnet (S 03H) permit made Cook Inlet salmon drift gillnet landings in the community from 1991-2017. Communities were included in the harvesting engagement analysis if the owner of a vessel which used a Cook Inlet salmon drift gillnet (S

[1] Jepson, M., & Colburn, L. L. (2013). *Development of social indicators of fishing community vulnerability and resilience in the US southeast and northeast regions*. US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

[2] A map of the most recent social indicators for coastal communities in the U.S. is available at: https://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map

[3] Himes-Cornell, A., & Kasperski, S. (2016). Using socioeconomic and fisheries involvement indices to understand Alaska fishing community well-being. *Coastal Management*, *44*(1), 36-70.

[4] National Standard 8 states "*Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirement of paragraph (2) [i.e., National Standard 2], in order to (a) provide for the sustained participation of such communities, and (b) to the extent practicable, minimize adverse economic impacts on such communities.*"

[5] Eagle River and Girdwood are included as part of Anchorage.

03H) permit and landed Cook Inlet salmon using drift gillnet gear (regardless of the community) resided in the community for any year from 2010 through 2018.[6] Processing engagement is represented by the amount of landings and associated revenues from landings in the community, the number of vessels delivering Cook Inlet salmon using drift gillnet gear in the community, and the number of processors in the community processing Cook Inlet salmon using drift gillnet gear. Harvesting engagement is represented by the Cook Inlet salmon drift gillnet landings and revenues associated with vessels owned by community residents (regardless of the location of landing), the number of vessels with Cook Inlet salmon drift gillnet landings owned by residents in the community, and the number of distinct resident vessel owners whose vessels made Cook Inlet salmon drift gillnet 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 large amount of landings or processing in their community, but have a large number of fishermen and/or vessel owners that participate in commercial fisheries 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. There are 27 years in the study and two PCFAs are conducted each year (processing engagement and harvesting engagement) for a total of 54 different PCFAs summarized below.

PCFA is a variable reduction strategy that separates a large number of correlated variables into a set of fewer, linearly independent components. The first component from each PCFA, which by definition explains the most variation in the data, is 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 engagement index and harvesting engagement 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 54 PCFAs. Each index is normalized to have a mean of zero and a standard deviation of one for each year across communities. These indices are relative scores in that they represent each community's engagement in commercial fisheries within a single year relative to all other communities in that year. Indices are then appended across all years to create a time series of relative engagement in these two aspects of commercial fisheries 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 particular year. These communities are used in additional analyses to explore the changes in their participation for communities that were highly engaged for at least one year from 1991-2017 for Cook Inlet salmon drift gillnet processing engagement or harvesting engagement. It is important to note that since 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 over time.

4.9.1.2 Regional Quotient

The regional quotient is a measure of the importance of the community's Cook Inlet salmon drift gillnet activities in terms of pounds landed or revenue generated from the entire Cook Inlet salmon drift gillnet fishery. It is calculated as the landings or revenue attributable to a community divided by the total landings or revenue from all communities and community groupings. The regional quotient is reported for revenue from landings in a community (similar to processing engagement). The regional quotient uses the

[6] The owner's community is determined from the CFEC vessel registration each year.

same criteria for inclusion as the processing and harvesting engagement indices and is presented for all communities that were highly engaged for at least one year from 1991-2017.

4.9.2 Results

This section will report performance metrics of community participation in Alaska fisheries from 1991-2017. Data were collected for 70 communities or community groupings throughout the U.S. that had either some commercial Cook Inlet salmon drift gillnet fisheries landings or residents who owned vessels that were used in commercial Cook Inlet salmon drift gillnet fishing during this period. There were 20 communities that had some Cook Inlet salmon drift gillnet landings occurring in their community and were included in the commercial processing engagement analysis. In contrast, 54 of the 63 communities had a resident who owned a vessel that participated in commercial Cook Inlet salmon drift gillnet fishing and therefore were included in the commercial harvesting engagement analysis.

4.9.2.1 Cook Inlet salmon drift gillnet Commercial Processing Engagement

The results of the commercial processing engagement PCFA analyses are shown in Table 1.7 which presents the eigenvalues, factor loadings, total variance explained, and Armor's theta reliability coefficient (Armor, 1973)[7] for all of the variables included in each PCFA. The results suggest very strong relationships among all variables, and that a single index based on the first extracted factor explains between 88% and 100% of the variation in each of the variables in each year. While it is uncommon to explain 100% of the variation in the variables, as only Kenai was accepting delivers of Cook Inlet salmon from S03H permits (using drift gillnet gear) from 2005-2007, the variance is all explained by the included variables and only Kenai has a positive index score over that period.

Table 1.7. Commercial Cook Inlet Salmon Drift Gillnet Processing Engagement PCFA Results.

	Eigenvalues				Factor Loadings				1st Eigenvalue Percent variance explained	Armor's Theta
Year	1	2	3	4	Ex-vessel value	Pounds landed in community	Number of vessels delivering	Number of processors		
1991	3.83	0.16	0.01	0.00	0.99	0.94	0.99	0.99	0.96	0.98
1992	3.92	0.07	0.02	0.00	0.99	0.98	1.00	1.00	0.98	0.99
1993	3.88	0.11	0.01	0.00	0.99	0.96	0.99	0.99	0.97	0.99
1994	3.80	0.19	0.02	0.00	0.99	0.93	0.99	0.99	0.95	0.98
1995	3.85	0.15	0.00	0.00	1.00	0.94	0.99	0.99	0.96	0.99
1996	3.89	0.10	0.01	0.00	0.99	0.96	0.99	0.99	0.97	0.99
1997	3.91	0.09	0.00	0.00	1.00	0.97	0.99	0.99	0.98	0.99
1998	3.90	0.10	0.00	0.00	1.00	0.96	1.00	1.00	0.98	0.99
1999	3.86	0.13	0.01	0.00	1.00	0.95	0.99	0.99	0.97	0.99
2000	3.93	0.07	0.00	0.00	1.00	0.97	1.00	1.00	0.98	0.99
2001	3.94	0.06	0.00	0.00	1.00	0.98	1.00	1.00	0.98	0.99

[7] Armor, D.J., 1973. Theta reliability and factor scaling. Sociological methodology, 5, pp.17-50.

2002	3.76	0.23	0.01	0.00	0.99	0.91	0.99	0.99	0.94	0.98
2003	4.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2004	3.97	0.02	0.01	0.00	0.99	0.99	1.00	1.00	0.99	1.00
2005	4.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2006	4.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2007	4.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2008	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2009	3.86	0.13	0.01	0.00	0.99	0.95	0.99	1.00	0.97	0.99
2010	3.83	0.16	0.01	0.00	0.95	0.97	1.00	1.00	0.96	0.99
2011	3.57	0.36	0.07	0.00	0.96	0.84	0.98	0.98	0.89	0.96
2012	3.83	0.17	0.00	0.00	0.99	0.93	0.99	0.99	0.96	0.98
2013	3.82	0.12	0.07	0.00	0.97	0.96	0.99	0.99	0.95	0.98
2014	3.83	0.15	0.03	0.00	0.99	0.94	0.99	0.99	0.96	0.99
2015	3.56	0.43	0.01	0.00	0.99	0.82	0.97	0.98	0.89	0.96
2016	3.56	0.43	0.00	0.00	0.99	0.80	0.98	0.98	0.89	0.96
2017	3.50	0.49	0.00	0.00	0.98	0.77	0.99	0.99	0.88	0.95

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 20 communities included in the analyses. These index scores are presented in Table 4 for the 8 community and community 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 1991-2017. These cells are shaded in Table 1.8. The index is an indicator of the degree of participation in a community relative to the participation of other communities. It is a measure of the presence of commercial fishing activity including pounds landed, revenue, processors and the number of delivering vessels in the Cook Inlet salmon drift gillnet fishery.

Table 1.8. Communities Highly Engaged in Cook Inlet Salmon Drift Gillnet Commercial Processing for One or More Years From 1991-2017*.

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Anchorage	-0.1	0.0	0.1	0.1	0.0	-0.2	-0.3	-0.3	-0.4	-0.3	-0.3	-0.4	-0.2	-0.3	-0.2	-0.2	-0.2	-0.1	-0.3	1.2	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
Homer	1.0	0.6	0.7	0.8	1.1	0.8	0.5	0.7	0.0	-0.2	0.5	0.8	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	0.9	1.2	1.3	1.6	1.5	1.4	1.1	1.8	2.4
Kasilof	0.7	0.3	0.4	0.6	0.5	0.5	0.8	0.6	0.9	0.1	0.2	0.3	-0.2	-0.2	-0.2	-0.2	-0.2	0.2	1.0	0.2	0.7	0.3	0.8	1.8	2.7	1.9	1.7
Kenai	3.8	4.0	4.0	4.0	3.9	4.0	4.0	4.1	4.0	4.2	4.0	4.0	4.2	4.2	4.2	4.2	4.2	4.2	3.7	3.0	3.7	3.7	3.4	3.4	2.8	3.1	2.8
Nikiski	-0.4	-0.4	-0.4	-0.3	-0.4	-0.4	-0.4	-0.3	-0.4	-0.3	0.6	0.3	-0.1	0.0	-0.2	-0.2	-0.2	-0.3	1.1	1.8	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4
Ninilchik	-0.1	-0.4	-0.1	-0.1	-0.2	0.0	-0.2	-0.2	-0.2	-0.1	0.0	0.1	-0.2	-0.1	-0.2	-0.2	-0.2	0.1	-0.4	-0.4	0.7	0.5	1.2	-0.2	0.3	-0.2	-0.1

*Shaded cells are index scores above one (highly engaged) for at least one year from 1991-2017.

Of the six communities found in Table 1.8 and displayed in Figure II, only Kenai was highly engaged in commercial processing all 27 years from 1991-2017. Kenai has the highest engagement scores over time, but declining engagement since 2009 with an increase from other processing communities. Kasilof and Homer had moderate but declining engagement throughout the 1990s until leaving the fishery in 2003-2007, but both have seen increases in their processing engagement in this fishery since 2009. Nikiski, Anchorage, and Ninilchik have had more variable engagement over time, but mostly in the 2009-2017 period, with a large increase in 2010 for Nikiski and Anchorage followed by exit from the processing sector since 2011. Ninilchik has had a higher overall level of engagement than Nikiski and Anchorage, particularly since 2011.

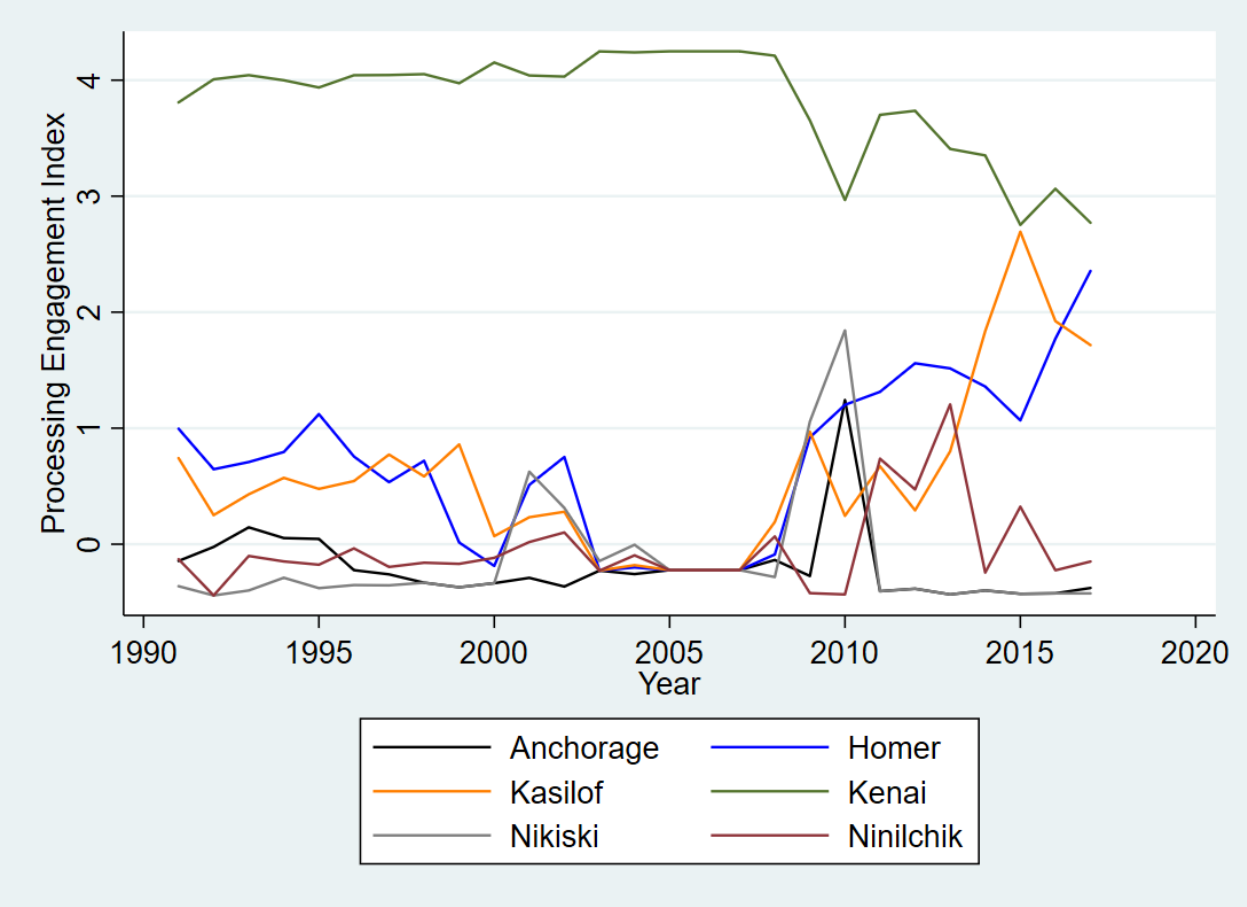


Figure II. Index scores of communities highly engaged in commercial Cook Inlet salmon drift gillnet processing for at least 1 year from 1991-2017.

4.9.2.2 Processing Regional Quotient

Another measure of a community's participation in commercial Cook Inlet salmon drift gillnet fisheries is its processing regional quotient of revenues, defined as the share of commercial revenues

within a community out of the total Cook Inlet salmon drift gillnet fishery revenues.[8] It is an indicator of the percentage contribution in revenue landed in that community relative the total revenue from all communities throughout the U.S. Figure JJ shows the processing regional quotient for revenue from 1991-2017. Due to confidentiality restrictions, communities are grouped into Kenai, the five "Other Highly Engaged Communities" for at least one year of Anchorage, Homer, Kasilof, Nikiski, and Ninilchik, and all other communities.

The most prominent communities for processing Cook Inlet salmon drift gillnet in terms of ex-vessel revenue over this period has been Kenai and accounts for approximately 68% of the value of Cook Inlet salmon drift gillnet retained in the North Pacific on average. This is followed by Kasilof and Homer at 11.4% and 11.1%, respectively. Each of the other three highly engaged communities for at least one year, Anchorage, Nikiski, and Ninilchik, represented 3% of the total ex-vessel revenues over the period 1991-2017.

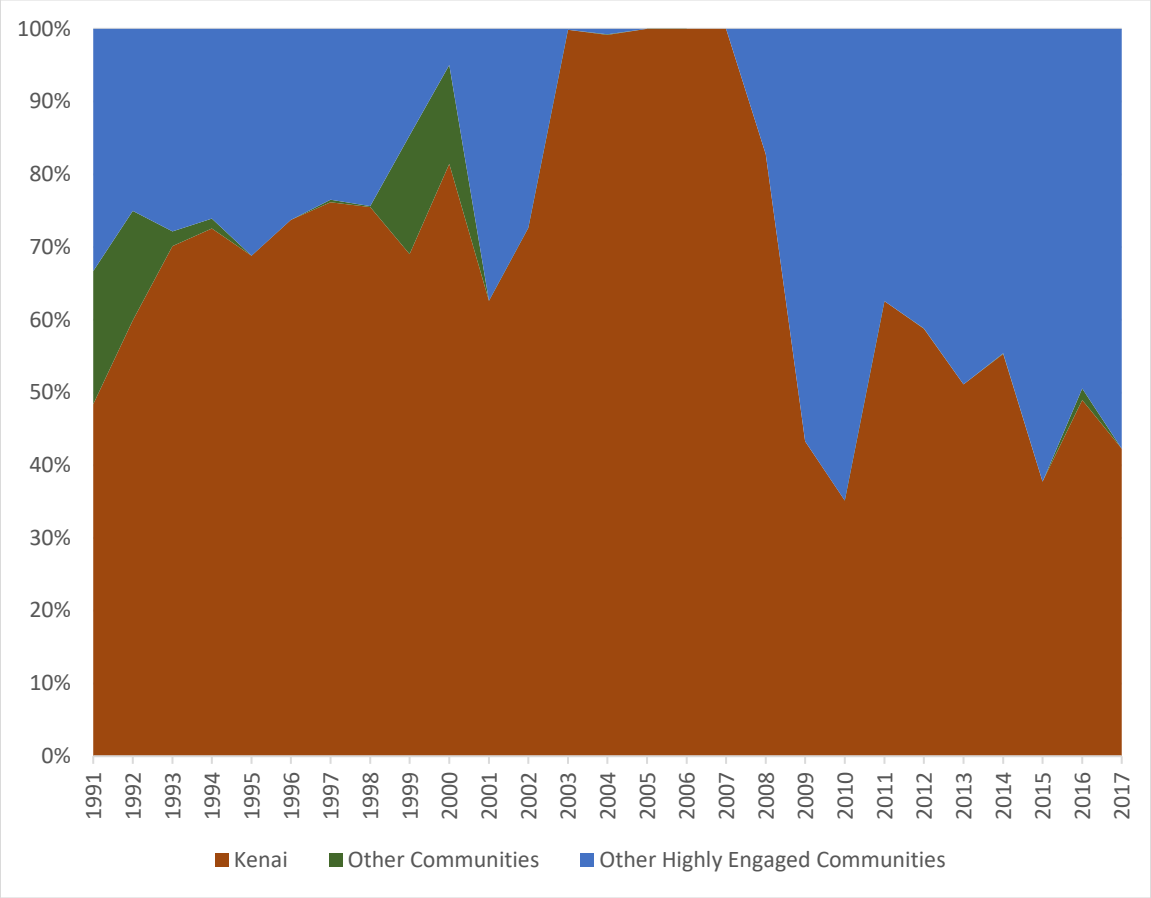


Figure JJ. Processing regional quotient of revenue for communities highly engaged in commercial Cook Inlet salmon drift gillnet processing for at least one year from 1991-2017.

4.9.2.3 Commercial Cook Inlet Salmon Drift Gillnet Harvesting Engagement

[8] The regional quotient for pounds is not calculated as pounds and revenues across communities are very highly correlated for a single species and does not show meaningful differences across communities, but is available upon request.

The results of the commercial Cook Inlet salmon drift gillnet harvesting engagement PCFA analyses are shown in Table 1.9 which presents the eigenvalues, factor loadings, total variance explained, and Armor's theta reliability coefficient (Armor, 1973)[9] 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 98% of the variation in each of the variables in each year.

Table 1.9. Commercial Cook Inlet Salmon Drift Gillnet Harvesting Engagement PCFA Results.

	Eigenvalues				Factor Loadings					
Year	1	2	3	4	Ex-vessel value by resident owned vessels	Pounds landed by resident owned vessels	Number of vessels owned by residents	Number of vessel owners	1st Eigenvalue Percent variance explained	Armor's Theta
1991	3.97	0.03	0.01	0.00	0.99	1.00	1.00	1.00	0.99	1.00
1992	3.95	0.05	0.01	0.00	0.98	1.00	1.00	1.00	0.99	1.00
1993	3.97	0.03	0.00	0.00	0.99	1.00	1.00	1.00	0.99	1.00
1994	3.94	0.04	0.02	0.00	0.99	0.99	1.00	1.00	0.98	0.99
1995	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
1996	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
1997	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
1998	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
1999	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2000	3.99	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2001	3.98	0.02	0.00	0.00	1.00	1.00	1.00	1.00	0.99	1.00
2002	3.98	0.02	0.00	0.00	1.00	1.00	1.00	1.00	0.99	1.00
2003	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2004	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2005	3.98	0.02	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2006	3.90	0.10	0.00	0.00	0.99	0.98	0.99	0.99	0.98	0.99
2007	3.98	0.02	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2008	3.97	0.03	0.00	0.00	1.00	0.99	1.00	1.00	0.99	1.00
2009	3.97	0.03	0.00	0.00	1.00	0.99	1.00	1.00	0.99	1.00
2010	3.98	0.02	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2011	3.98	0.02	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2012	3.99	0.01	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
2013	3.97	0.03	0.00	0.00	1.00	0.99	1.00	1.00	0.99	1.00
2014	3.98	0.02	0.00	0.00	1.00	1.00	1.00	1.00	0.99	1.00
2015	3.95	0.05	0.00	0.00	1.00	0.99	0.99	0.99	0.99	1.00

[9] Armor, D.J., 1973. Theta reliability and factor scaling. Sociological methodology, 5, pp.17-50.

2016	3.98	0.02	0.00	0.00	1.00	1.00	1.00	1.00	0.99	1.00
2017	3.94	0.06	0.00	0.00	0.99	0.99	0.99	0.99	0.98	0.99

Index scores derived from the PCFA results are presented in Table 6 for the 8 communities that were highly engaged (index score above one, which is one standard deviation above the mean of zero) for any year from 1991-2017. These cells are shaded in Table 1.10. The harvesting engagement index is an indicator of the degree of participation in a community relative to the participation of all other communities in the U.S. It is a measure of the presence of commercial Cook Inlet salmon drift gillnet fishing activities through residents who own commercial fishing vessels and includes Cook Inlet salmon drift gillnet pounds landed, revenue, the number of vessels harvesting Cook Inlet salmon with drift gillnet gear, and the total number of vessel owners harvesting Cook Inlet salmon using drift gillnet gear in a community.

Table 1.10. Communities Highly Engaged in Cook Inlet Salmon Drift Gillnet Commercial Harvesting for One or More Years From 1991-2017*.

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Anchorage	1.8	1.6	1.6	1.3	1.7	1.6	1.4	1.4	1.3	1.5	1.7	1.2	0.8	1.1	0.7	0.7	1.0	1.1	1.0	1.0	1.0	1.0	0.8	0.9	1.0	1.1	1.2
Homer	4.3	4.0	4.1	4.6	4.5	4.4	4.6	4.7	4.8	4.7	4.3	4.3	4.8	5.2	5.8	6.1	5.4	5.7	5.9	5.9	6.0	6.2	6.4	6.3	6.5	6.3	6.5
Kasilof	1.5	1.5	1.4	1.3	1.6	1.6	1.5	1.5	1.5	1.4	1.5	1.8	1.7	1.6	1.3	1.5	1.4	1.3	1.3	1.1	1.1	0.8	0.8	0.9	0.9	1.0	1.2
Kenai	3.5	3.3	3.2	2.6	3.2	3.4	3.1	3.0	3.0	2.7	3.1	3.0	3.0	2.9	2.4	2.6	2.5	2.5	2.6	2.7	2.3	2.3	2.3	2.2	2.2	2.2	1.8
Oregon	2.1	2.5	2.5	2.6	2.1	2.5	2.3	2.3	2.5	2.7	2.5	2.5	2.2	2.0	2.1	1.4	1.8	1.7	1.8	1.8	1.8	1.9	1.6	1.6	1.3	1.1	1.2
Other US	0.8	1.1	1.0	1.7	0.8	1.0	1.1	0.8	0.7	0.8	1.1	1.0	1.0	0.9	0.8	0.8	1.4	1.3	1.3	1.0	1.3	1.2	1.2	1.3	1.3	1.3	1.0
Other WA	2.8	3.1	3.1	3.1	2.7	2.6	2.8	2.8	2.6	2.7	2.9	2.7	2.7	2.2	2.1	1.7	2.3	2.3	1.8	2.1	2.2	1.9	1.6	1.7	1.4	1.6	1.5
Soldotna	1.9	2.1	2.0	1.5	2.1	1.8	2.1	2.2	1.9	2.2	2.2	2.5	2.3	2.1	1.8	1.7	2.2	1.7	1.5	1.5	1.3	1.0	1.1	1.2	1.3	1.6	1.5

*Shaded cells are index scores above one (which is one standard deviation above the mean of zero) for at least one year from 1991-2017.

Figure KK displays the commercial Cook Inlet salmon drift gillnet harvesting engagement index for the 8 communities listed in Table 6. These trends will be explored in more detail below, but the most apparent trend from Figure KK is that the Seattle Metropolitan Statistical Area (MSA – which includes King, Snohomish and Pierce Counties in Washington) grouping has a substantially higher level of harvesting engagement than many of the Alaska communities and community groupings, averaging 4.71 over the entire period while the next two highest average index scores are for St. Paul Island and Homer at 2.14 and 2.06, respectively.

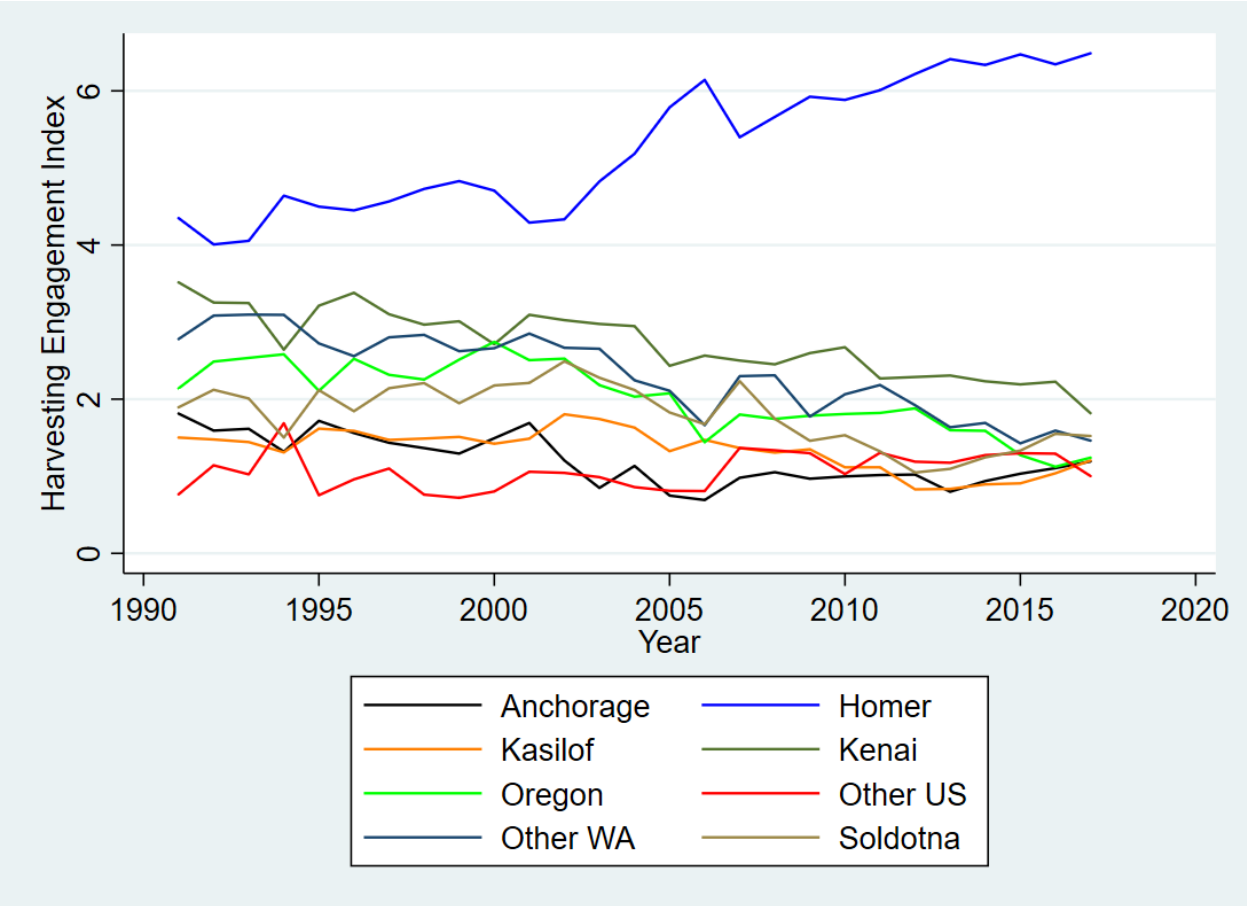


Figure KK. Index scores of communities highly engaged in commercial Cook Inlet salmon drift gillnet harvest for at least 1 year from 1991-2017.

Of the eight communities listed in Table 1.10 and shown in Figure KK, five communities were highly engaged in commercial harvesting for all years from 1991-2017 (Figure LL). They are Homer, Kenai, Oregon, Other Washington, and Soldotna. Homer has the highest commercial Cook Inlet drift gillnet salmon harvesting engagement scores over time, with an increasing index score, accelerating after 2003. All other communities that are highly engaged in the harvesting aspect of this fishery, Kenai, Oregon, Other Washington, and Soldotna have each had periods of higher and lower engagement with this fishery but have seen overall declining trends in the engagement indices over time.

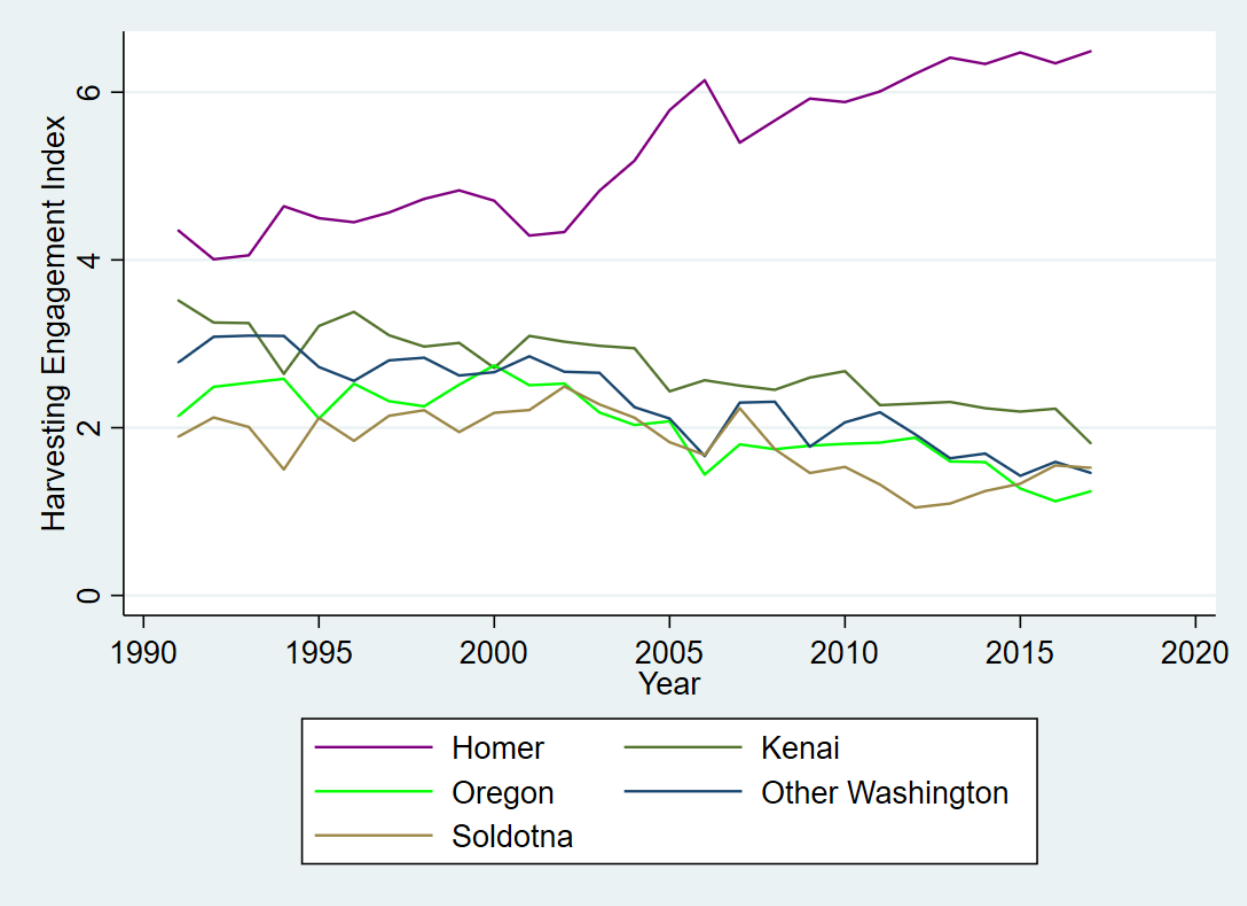


Figure LL. Index scores of communities highly engaged in commercial Cook Inlet salmon drift gillnet harvest for all years from 1991-2017.

4.9.2.4 Participation Summary

Based on the community engagement index scores for both commercial Cook Inlet salmon drift gillnet processing and commercial Cook Inlet salmon drift gillnet 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 1.00001) for each year. The number of years a community is in each category for the processing and harvesting engagement indices is presented in Table 1.11. There are 19 communities or community groupings in Table 1.11 that had medium, medium-high, or high engagement in either commercial Cook Inlet salmon drift gillnet harvesting or commercial Cook Inlet salmon drift gillnet processing engagement and 10 communities were highly engaged in one aspect of Cook Inlet salmon drift gillnet commercial fisheries in any year from 1991-2017. There were 6 communities that were highly engaged in commercial Cook Inlet salmon drift gillnet processing engagement and 8 that were highly engaged in commercial Cook Inlet salmon drift gillnet harvesting engagement for at least one year from 1991-2017.

Table 1.11. Number of years by commercial Cook Inlet salmon drift gillnet processing and commercial Cook Inlet salmon drift gillnet harvesting engagement level. Alaska communities not listed had low commercial Cook Inlet salmon drift gillnet processing and commercial Cook Inlet salmon drift gillnet harvesting engagement in all years.

	Harvesting Engagement				Processing Engagement			
	Low	Medium	Medium-High	High	Low	Medium	Medium-High	High
Anchor Point	2	16	9	0	0	0	0	0
Anchorage	0	0	8	19	23	3	0	1
California	6	21	0	0	0	0	0	0
Delta Junction	26	1	0	0	0	0	0	0
Fritz Creek	26	1	0	0	0	0	0	0
Homer	0	0	0	27	7	1	10	9
Kasilof	0	0	4	23	5	9	9	4
Kenai	0	0	0	27	0	0	0	27
Kodiak	22	5	0	0	26	1	0	0
Nikiski	1	26	0	0	23	1	1	2
Nikolaevsk	20	7	0	0	0	0	0	0
Ninilchik	11	16	0	0	20	5	1	1
Oregon	0	0	0	27	0	0	0	0
Other US	0	0	10	17	0	0	0	0
Other Washington	0	0	0	27	0	0	0	0
Seward	26	1	0	0	24	1	2	0
Soldotna	0	0	0	27	26	0	1	0
Sterling	12	15	0	0	0	0	0	0
Wasilla	13	14	0	0	0	0	0	0

4.10 Suite of affected communities

4.10.1 Community vulnerabilities

- **Social vulnerability** - social factors that can shape either an individual or community's ability to adapt to change. These factors exist within all communities regardless of the importance of fishing.

    - Personal disruption represents factors that disrupt a community member's ability to respond to change because of personal circumstances affecting family life or educational levels or propensity to be affected by poverty. A high rank indicates more personal disruption and a more vulnerable population.
    - Population composition shows the presence of populations who are traditionally considered more vulnerable due to circumstances often associated with low incomes and fewer resources. A high rank indicates a more vulnerable population.
    - Poverty is a commonly used indicator of vulnerable populations. A high rank indicates a high rate of poverty and a more vulnerable population.
    - Labor force characterizes the strength and stability of the labor force and employment opportunities that may exist. A high rank means likely fewer employment opportunities and a more vulnerable population.
    - Housing characteristics is a measure of infrastructure vulnerability and includes factors that indicate housing that may be vulnerable to coastal hazards. A high rank means a more vulnerable infrastructure and a more vulnerable population. On the other hand, the opposite interpretation might be that more affordable housing could be less vulnerability for some populations.

- **Gentrification pressure** - those factors that, over time may indicate a threat to the viability of a commercial or recreational working waterfront, including infrastructure.

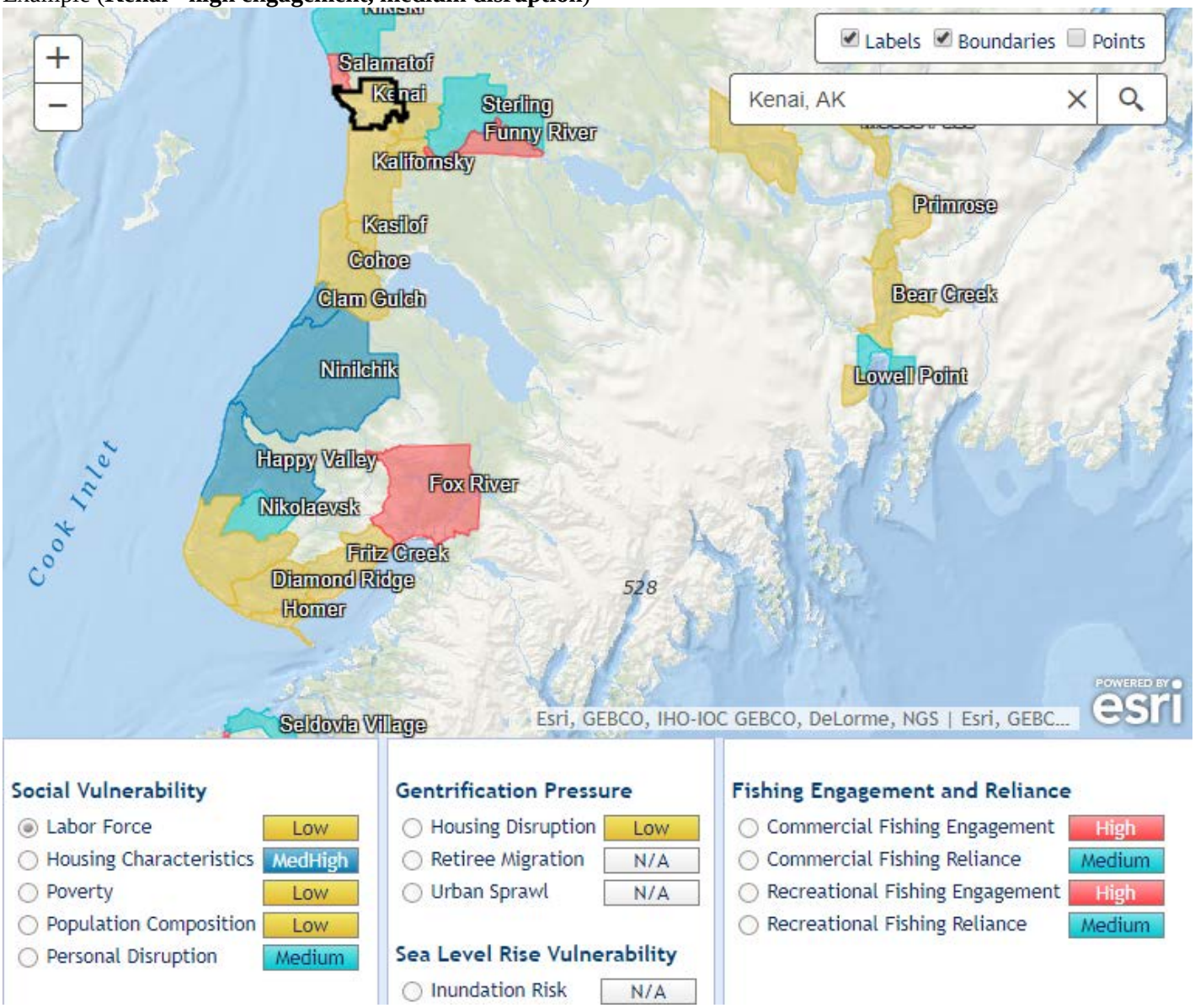
    - Housing Disruption represents factors that indicate a fluctuating housing market where some displacement may occur due to rising home values and rents. A high rank means more vulnerability for those in need of affordable housing and a population more vulnerable to gentrification.
    - Retiree migration characterizes areas with a higher concentration of retirees and elderly people in the population. A high rank indicates a population more vulnerable to gentrification as retirees seek out the amenities of coastal living.
    - Urban sprawl describes areas experiencing gentrification through increasing population and higher costs of living. A high rank indicates a population more vulnerable to gentrification.

- **Fishing engagement and reliance** - the importance or level of dependence of commercial or recreational fishing to coastal communities

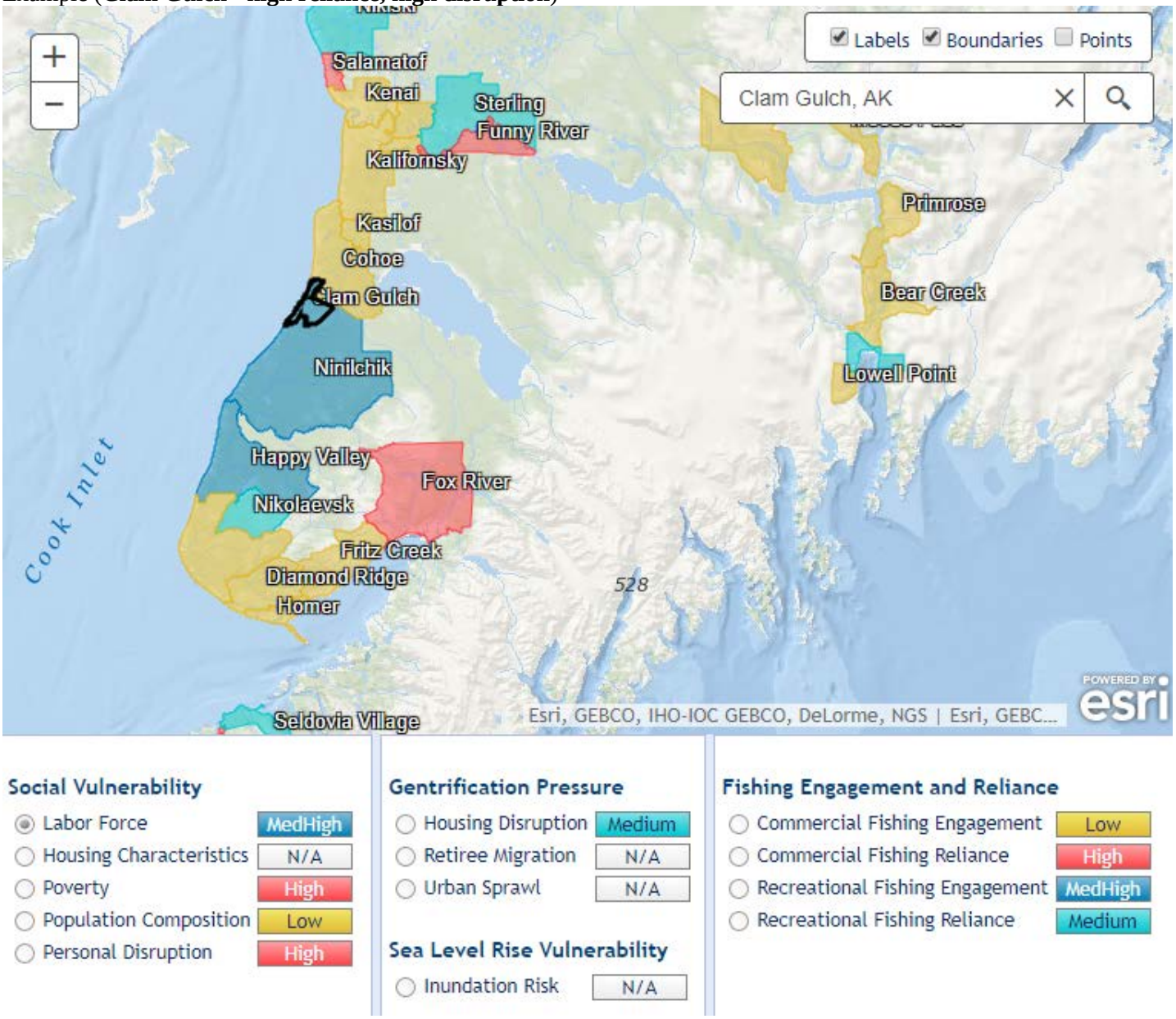
    - Commercial fishing engagement measures the presence of commercial fishing through fishing activity as shown through permits and vessel landings. A high rank indicates more engagement.
    - Commercial fishing reliance measures the presence of commercial fishing in relation to the population of a community through fishing activity. A high rank indicates more reliance.
    - Recreational fishing engagement measures the presence of recreational fishing through fishing activity estimates. A high rank indicates more engagement.

- Recreational fishing reliance measures the presence of recreational fishing in relation to the population of a community. A high rank indicates increased reliance.

Example (**Kenai - high engagement, medium disruption**)



Example (**Clam Gulch - high reliance, high disruption**)



[1] Jepson, M., & Colburn, L. L. (2013). *Development of social indicators of fishing community vulnerability and resilience in the US southeast and northeast regions*. US Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

[2] A map of the most recent social indicators for coastal communities in the U.S. is available at: https://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map

[3] Himes-Cornell, A., & Kasperski, S. (2016). Using socioeconomic and fisheries involvement indices to understand Alaska fishing community well-being. *Coastal Management*, *44*(1), 36-70.

[4] National Standard 8 states "*Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirement of paragraph (2) [i.e., National Standard 2], in order to (a) provide for the sustained participation of such communities, and (b) to the extent practicable, minimize adverse economic impacts on such communities.*"

[5] Eagle River and Girdwood are included as part of Anchorage.

[6] The owner's community is determined from the CFEC vessel registration each year.

[7] Armor, D.J., 1973. Theta reliability and factor scaling. Sociological methodology, 5, pp.17-50.

[8] The regional quotient for pounds is not calculated as pounds and revenues across communities are very highly correlated for a single species and does not show meaningful differences across communities but is available upon request.

[9] Armor, D.J., 1973. Theta reliability and factor scaling. Sociological methodology, 5, pp.17-50.