APPENDIX B

Community Fisheries Engagement Indices throughout the BSAI Crab Rationalization Program

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C**ommunity Fisheries Engagement Indices throughout the BSAI Crab Rationalization Program**

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Introduction

The Alaska Fisheries Science Center's Economic and Social Sciences Research Program (ESSRP) has developed a set of fisheries engagement indices using pre-existing data for a majority of Alaska communities. These indices allow policymakers to examine the degree to which Alaska communities are involved in commercial fisheries (Kasperski and Himes-Cornell, 2014; Himes-Cornell and Kasperski, 2016). The analysis presented here examines community involvement in a specific catch share fishery in the North Pacific: the Bering Sea and Aleutian Islands (BSAI) Crab Rationalization fisheries. All Crab Rationalization fisheries are aggregated together in this analysis and henceforth will be referred to as the CR crab fisheries. To conduct this analysis, ESSRP gathered information on communities throughout the United States that participate in the fishery either through processing crab locally or owning vessels that harvest CR crab. The purpose of this analysis is to explore the degree to which communities are engaged in the CR crab fisheries and how their engagement has changed over time. Two basic types of crab fisheries involvement are considered, commercial processing and commercial harvesting, and numerical indices of engagement are created for each of them.

Processing engagement represents the scale of the processing industry in the community and represents landings being made in the community. Harvesting engagement represents the communities where the revenue that harvesters are earning from CR crab fishing is likely being spent and is expected to have some economic impacts. Harvesting engagement includes any CR crab activities undertaken by vessels owned by community residents, regardless of landing port. By separating commercial processing from commercial harvesting, the indices presented here highlight the importance for communities that may not have a large amount of crab landings or processing in their community, but have a large number of fishermen and/or vessel owners that participate in the CR crab fisheries that are based in the community. These indicators give policy makers and communities themselves a quantitative measure of community involvement in the CR crab fisheries which will help provide information about which communities have been most affected by the implementation of the Crab Rationalization Program.

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Alternative Analyses Considered

This analysis is our best representation of community engagement in the CR crab fisheries pre- and post-rationalization. Several other models and types of analysis were carried out as part of this process but were ultimately discarded for a variety of reasons. Of particular relevance is the difference in differences approach that was brought before the SSC in April, 2015 (Card and Krueger, 1994). As can be seen from the following analysis, both harvesting and processing engagement is concentrated in a small number of communities. Assuming that these communities were the most impacted by the crab rationalization program, the small number of affected communities makes it difficult to generate adequate treatment and control groups to test whether there were significant differences in socioeconomic conditions between the two over time and whether these differences could be attributed to the BSAI Crab Rationalization Program. These difficulties were exacerbated by the substantial participation of Kodiak and Unalaska/Dutch Harbor which are difficult communities to find similar control communities for in Alaska as well as for communities like Seattle that are highly engaged in fishing but the fishing industry does not constitute a majority of the local economy and changes in the fishing industry are likely to be difficult to disentangle from broader economic trends. If these issues could be overcome, there is still some potential for this approach, but at this time we did not feel that it would be appropriate to include this type of approach as part of the 10-year review of the BSAI Crab Rationalization Program.

Methods

The ESSRP collected secondary data from state and federal sources for 212 communities throughout the U.S., including 27 from Alaska, 96 from Washington, 29 from Oregon, and 60 other communities in the U.S. These communities were aggregated into a smaller set of 32 communities used in the analysis which include all 27 communities in Alaska and then 4 regional groupings including the Seattle Metropolitan Statistical Area (Seattle MSA) which includes 45 communities, Other Washington includes 51 communities, Oregon includes 29 communities, All Other USA includes 60 communities, and the At-Sea sector which includes both catcher/processors and landings made to inshore floating processors. The At-Sea sector grouping combines the catcher/processors and inshore floating processors in this analysis because the location of landings is difficult to assign to a physical community for both groups (which is our primary focus) and is not always consistently reported for this sector over time.

Communities were included in the study population if any Crab Rationalization Program crab landings were made in the community or if the owner of a vessel that fished in the CR crab fishery resides in the community for any CR crab fishing season from 1998/1999 through 2014/2015.[5] The analysis uses and aggregates values for all variables across all CR crab fisheries for each community

[5] The owner's community is determined from the CFEC vessel registration in a given year.

(or grouping) in a fishing season and separates variables into two categories of fisheries involvement: commercial processing and commercial harvesting. Processing engagement is represented by the amount of CR crab landings and associated revenues from landings in the community, the number of vessels delivering CR crab in the community, and the number of processors in the community processing CR crab. Harvesting engagement is represented by the CR crab landings and revenues associated with vessels owned by community residents, the number of vessels with CR crab landings owned by residents in the community, and the number of distinct vessel owners with CR crab landings 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 relative engagement. There are 17 fishing seasons in the study and two PCFAs to be conducted for each fishing season (processing engagement and harvesting engagement) for a total of 34 different PCFAs conducted. 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 by using the regression method of summing the standardized coefficient scores multiplied by the included variables. In this case, we achieve a single factor solution for each PCFA and therefore, generate a unique processing index and harvesting index value for each community in each year.[6] These indices are relative scores in that they represent each community's engagement in the CR crab fisheries within a single fishing season relative to all other communities in that fishing season. Indices are then combined across all fishing seasons to create a time series of relative engagement in the CR crab fisheries over time. It is important to note that since these are relative indices, the large decrease in active crab vessels post-rationalization will only cause a change in the indices if one community loses a larger share of their vessels (or other CR crab activities) than another community. If the losses are proportional to the existing CR crab fishery related activities pre-rationalization, there will not be a change in the indices post-rationalization.

Results

A total of 32 communities or groupings met the criteria for inclusion in the analysis. The results of the commercial processing and commercial harvesting engagement analyses are shown in Tables 1 and 2, respectively. Each table 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. Results from both tables suggest very strong relationships among variables and that a single index best represents the trends in all four included variables as indicated by the large first eigenvalue and very small subsequent eigenvalues and the high percentage of variance explained (Kim and Mueller, 1978a and 1978b).

[6] Each index is normalized to be mean zero and standard deviation one for each fishing season.

Table 1: Commercial Processing Engagement PCFA Results.

Fishing Season	Eigenvalues				Factor Loadings				Percent variance explained	Armor's Theta
	1	2	3	4	Ex-vessel value	Pounds landed in community	Number of vessels delivering	Number of processors		
1998/1999	**3.86**	0.12	0.02	0.00	0.9978	0.9903	0.9873	0.9529	96.47%	0.9878
1999/2000	**3.66**	0.31	0.02	0.00	0.9571	0.9952	0.9901	0.8814	91.59%	0.9694
2000/2001	**3.59**	0.36	0.04	0.01	0.9708	0.9854	0.9802	0.8465	89.77%	0.9620
2001/2002	**3.52**	0.42	0.04	0.01	0.9615	0.9782	0.9829	0.8204	88.01%	0.9546
2002/2003	**3.58**	0.38	0.03	0.01	0.9655	0.9831	0.9868	0.8424	89.55%	0.9611
2003/2004	**3.65**	0.33	0.02	0.00	0.9713	0.9851	0.9911	0.8666	91.18%	0.9678
2004/2005	**3.60**	0.38	0.02	0.01	0.9765	0.9834	0.9867	0.8371	89.88%	0.9625
2005/2006	**3.54**	0.36	0.10	0.01	0.9575	0.9899	0.9595	0.8484	88.43%	0.9564
2006/2007	**3.82**	0.15	0.03	0.00	0.9735	0.9952	0.9891	0.9485	95.40%	0.9839
2007/2008	**3.66**	0.25	0.08	0.01	0.9610	0.9878	0.9712	0.9068	91.62%	0.9695
2008/2009	**3.73**	0.17	0.08	0.01	0.9527	0.9922	0.9743	0.9445	93.33%	0.9762
2009/2010	**3.77**	0.17	0.05	0.01	0.9619	0.9895	0.9786	0.9510	94.16%	0.9793
2010/2011	**3.83**	0.11	0.06	0.01	0.9824	0.9924	0.9794	0.9571	95.63%	0.9848
2011/2012	**3.88**	0.08	0.03	0.01	0.9882	0.9908	0.9923	0.9702	97.10%	0.9901
2012/2013	**3.86**	0.09	0.04	0.01	0.9849	0.9896	0.9869	0.9696	96.59%	0.9882
2013/2014	**3.89**	0.07	0.03	0.01	0.9835	0.9946	0.9798	0.9874	97.28%	0.9907
2014/2015	**3.85**	0.10	0.04	0.01	0.9739	0.9898	0.9857	0.9743	96.22%	0.9869

Table 2: Commercial Harvesting Engagement PCFA Results.

Fishing Season	Eigenvalues				Factor Loadings				Percent variance explained	Armor's Theta
	1	2	3	4	Ex-vessel value	Pounds landed in community	Number of owners	Number of vessels		
1998/1999	**4.00**	0.00	0.00	0.00	0.9998	0.9999	0.9999	0.9998	99.97%	0.9999
1999/2000	**4.00**	0.00	0.00	0.00	0.9997	0.9996	0.9996	0.9997	99.93%	0.9998
2000/2001	**3.99**	0.01	0.00	0.00	0.9984	0.9993	0.9987	0.9991	99.77%	0.9992
2001/2002	**4.00**	0.00	0.00	0.00	0.9997	0.9999	0.9997	0.9998	99.95%	0.9998
2002/2003	**4.00**	0.00	0.00	0.00	0.9996	0.9994	0.9995	0.9995	99.90%	0.9997
2003/2004	**4.00**	0.00	0.00	0.00	0.9998	0.9998	0.9997	0.9998	99.95%	0.9998
2004/2005	**3.99**	0.00	0.00	0.00	0.9995	0.9993	0.9991	0.9996	99.87%	0.9996
2005/2006	**3.98**	0.02	0.00	0.00	0.9981	0.9971	0.9971	0.9981	99.52%	0.9984
2006/2007	**3.99**	0.01	0.00	0.00	0.9988	0.9986	0.9986	0.9986	99.73%	0.9991
2007/2008	**3.99**	0.01	0.00	0.00	0.9981	0.9986	0.9984	0.9982	99.67%	0.9989
2008/2009	**3.98**	0.02	0.00	0.00	0.9978	0.9982	0.9982	0.9977	99.60%	0.9986
2009/2010	**3.99**	0.00	0.00	0.00	0.9996	0.9991	0.9992	0.9995	99.87%	0.9996
2010/2011	**3.99**	0.01	0.00	0.00	0.9993	0.9990	0.9990	0.9990	99.82%	0.9994
2011/2012	**4.00**	0.00	0.00	0.00	0.9996	0.9994	0.9996	0.9992	99.89%	0.9996
2012/2013	**3.99**	0.01	0.00	0.00	0.9991	0.9988	0.9992	0.9983	99.77%	0.9992
2013/2014	**3.99**	0.01	0.00	0.00	0.9989	0.9993	0.9993	0.9986	99.80%	0.9993
2014/2015	**3.99**	0.01	0.00	0.00	0.9993	0.9993	0.9994	0.9989	99.84%	0.9995

In addition to the goodness of fit statistics of the analyses provided in Tables 1 and 2, each of the analyses provides an index score for each of the 32 communities. Based on the community engagement index scores determined through each PCFA, communities were categorized into low, medium, and high engagement for each fishing season. Table 3 presents the number of fishing seasons for which a community is in each category for the processing and harvesting engagement indices. Low engagement reflects index scores below the mean of 0. Medium engagement reflects index scores between 0 and 1, which are above the mean and below one standard deviation. High engagement reflects index scores greater than or equal to 1, which reflects scores equal to or above one standard deviation from the mean community score.

There are only four communities that are highly engaged in each of the harvesting and processing indices, and there is no overlap between them. For processing engagement, Unalaska/Dutch Harbor was highly engaged for all 17 fishing seasons, followed by the At-Sea grouping with 14 fishing seasons, Saint Paul with 11 fishing seasons, and Akutan with 6 fishing seasons being highly engaged.

Table 3: Number of CR crab fishing Seasons by Processing and Harvesting Engagement Level

Community	Processing Engagement			Harvesting Engagement		
	Low*	Medium†	High‡	Low*	Medium†	High‡
Adak, AK	12	5	0	17	0	0
Akutan, AK	0	11	6	17	0	0
All Other USA	17	0	0	17	0	0
Anchorage, AK	17	0	0	8	8	1
At-Sea	1	2	14	17	0	0
Atka, AK	17	0	0	17	0	0
Big Lake, AK	17	0	0	17	0	0
Cordova, AK	17	0	0	17	0	0
Dillingham, AK	17	0	0	17	0	0
Homer, AK	17	0	0	9	8	0
Juneau, AK	17	0	0	17	0	0
Kenai, AK	17	0	0	17	0	0
Ketchikan, AK	17	0	0	17	0	0
King Cove, AK	0	17	0	17	0	0
Kodiak, AK	0	17	0	0	13	4
Ninilchik, AK	17	0	0	17	0	0
Nome, AK	17	0	0	17	0	0
Oregon	17	0	0	0	16	1
Other Washington	17	0	0	0	17	0
Petersburg, AK	17	0	0	17	0	0
Saint Paul, AK	1	5	11	17	0	0
Sand Point, AK	17	0	0	17	0	0
Seattle MSA	17	0	0	0	0	17
Seldovia, AK	17	0	0	17	0	0
Seward, AK	17	0	0	17	0	0
Sitka, AK	17	0	0	17	0	0
Soldotna, AK	17	0	0	17	0	0
Unalakleet, AK	17	0	0	17	0	0
Unalaska/Dutch Harbor, AK	0	0	17	17	0	0
Valdez, AK	17	0	0	17	0	0
Wasilla, AK	17	0	0	17	0	0
Yakutat, AK	17	0	0	17	0	0

*Low engagement reflects index scores below the mean of 0.
† Medium engagement reflects index scores between 0 and 1, which are above the mean and below one standard deviation.
‡ High engagement reflects index scores greater than or equal to 1, which reflects scores above one standard deviation.

Figure 1 presents the processing engagement index scores for each of the four highly engaged community groupings for all fishing seasons 1998/1999-2014/2015 and shows a relatively stable trend for Unalaska/Dutch Harbor, but a general increasing trend for Saint Paul and Akutan, while a declining trend for the At-Sea grouping. Some caution is warranted when interpreting the changes in indices for the At-Sea grouping. Reporting in this sector is not always consistent within and across years as to the location of landings and changes in the indices could be indicative of changes in reporting rather than changes in actual landings.

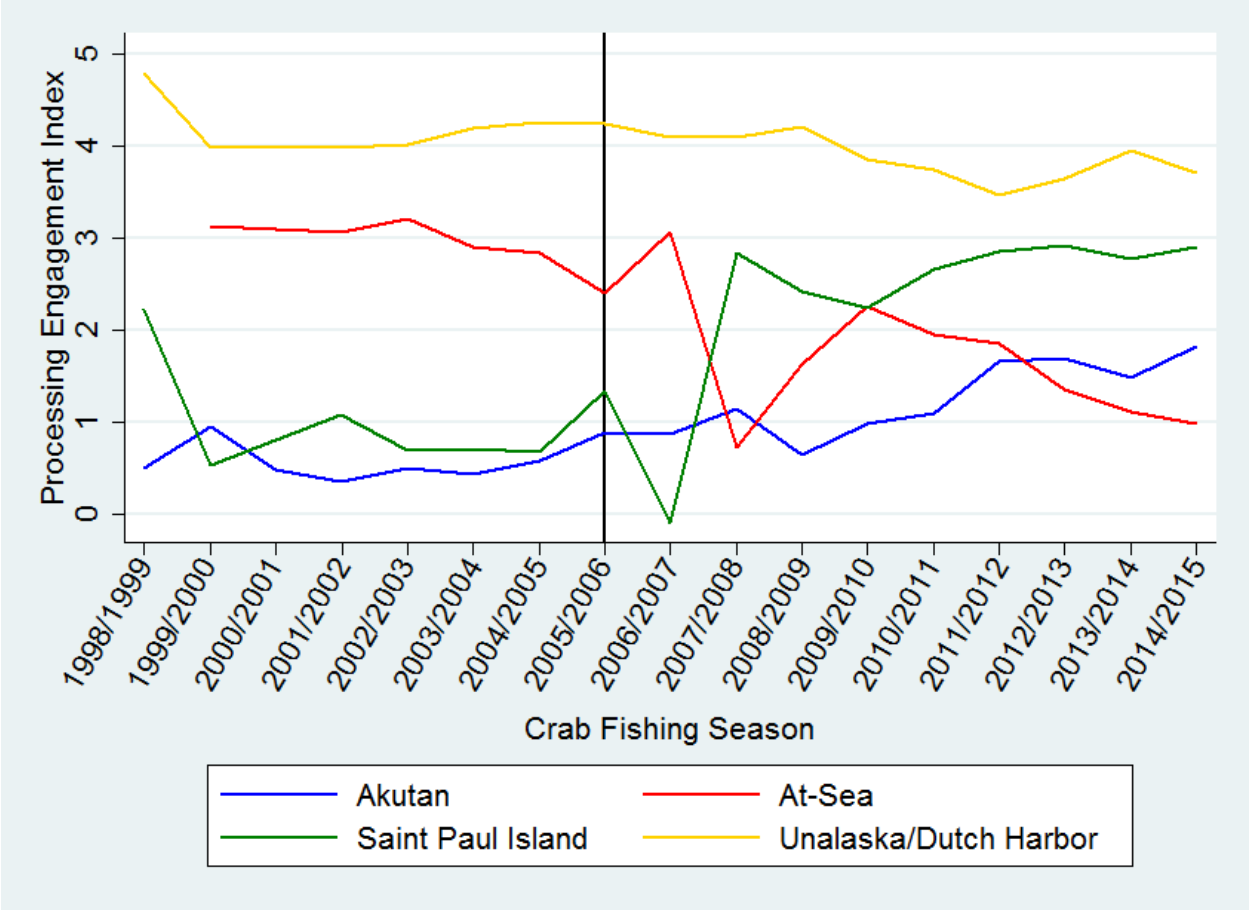

Figure 1: Processing Engagement Index for Highly Engaged Communities

In contrast to processing engagement, the harvesting sector is substantially more mobile and changes in the indices could reflect vessels being sold or exiting the fishery, but also could reflect owner migration to other communities. In terms of harvesting engagement, the Seattle MSA grouping was highly engaged for all 17 fishing seasons, followed by Kodiak with 4 fishing seasons, and Anchorage and Oregon both highly engaged for only 1 year. Figure 2 presents the harvesting engagement index scores for each of the four highly engaged community groupings for all fishing seasons 1998/1999-2014/2015 and shows a relatively stable trend for the Seattle MSA grouping, but a general increasing trend for Anchorage and Oregon and a slightly declining trend for the Kodiak. These results demonstrate the high degree of engagement from communities outside of Alaska in the crab harvesting sector, with the Seattle MSA being by far the dominant community in this sector.

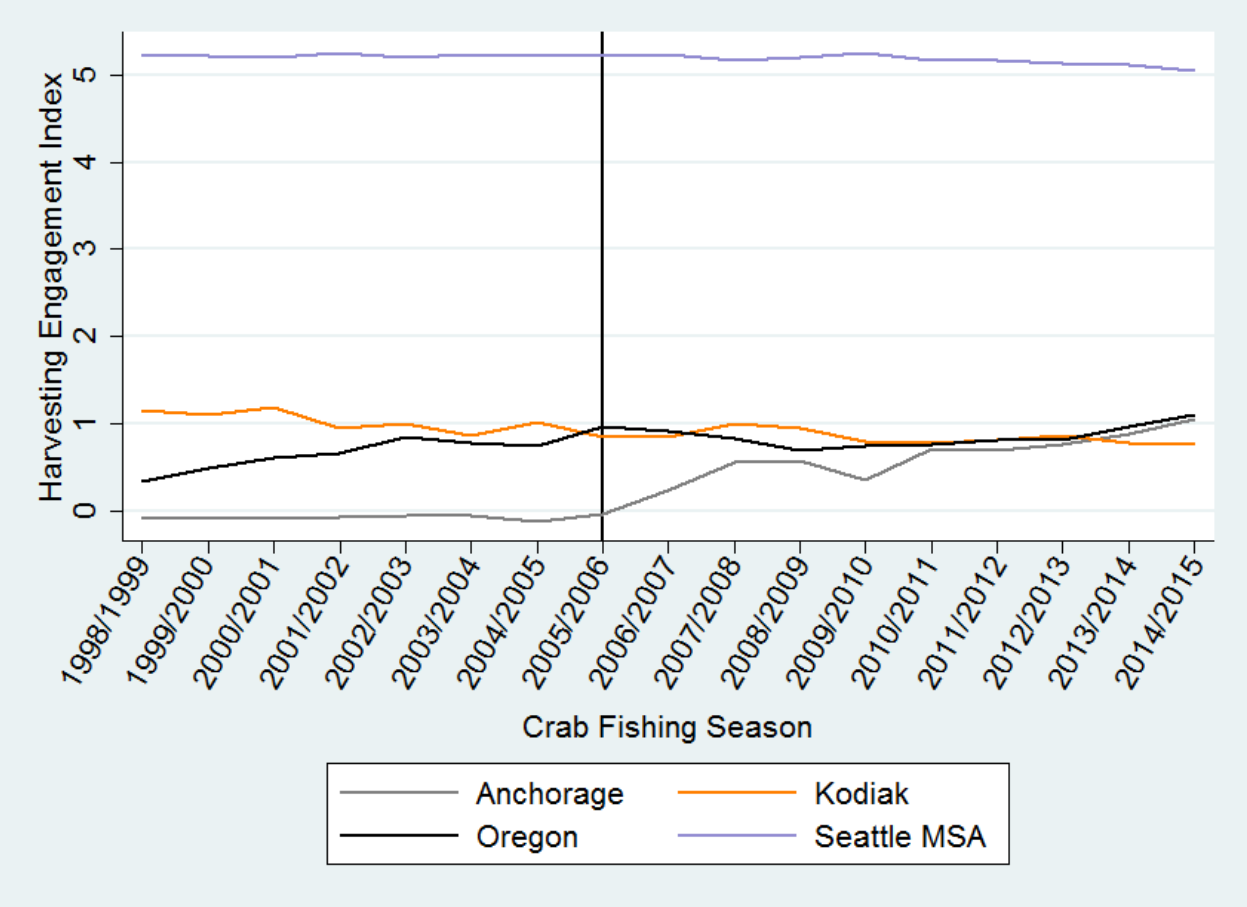

Figure 2: Harvesting Engagement Index for Highly Engaged Communities

Comparison of pre-rationalization period (1998/1999-2004/2005) with the first five fishing seasons post-rationalization (2005/2006-2009/2010)

The implementation of the Crab Rationalization Program had the potential to drastically alter the communities that were engaged in the processing and harvesting sectors of the CR crab fisheries. In order to better understand the extent to which communities were impacted by the Crab Rationalization Program, we calculated the percentage change in the processing engagement index between the average of the pre-rationalization fishing seasons (1998/1999-2004/2005) to the average of the first five fishing seasons post rationalization (2005/2006-2009/2010).[7] The results are displayed in Figure 3. Few communities felt large increases or decreases over this time period and there were few spatial patterns evident, and sometimes similar communities indicated divergent change over time. For example, while King Cove experienced a major increase in processing, nearby Sand point saw a moderate decrease. One notable exception was the increase in processing

[7] All percentage changes are bias corrected to account for changes in relative index scores across fishing seasons in the time series such that communities with no engagement in an index have a zero percentage change.

engagement for the neighboring communities of Akutan and Unalaska/Dutch Harbor. Three communities experienced increases in processing engagement over these periods of over 25%, Akutan, King Cove, and Saint Paul, while Adak and the At-Sea grouping experienced a decline of over 25% in processing engagement.

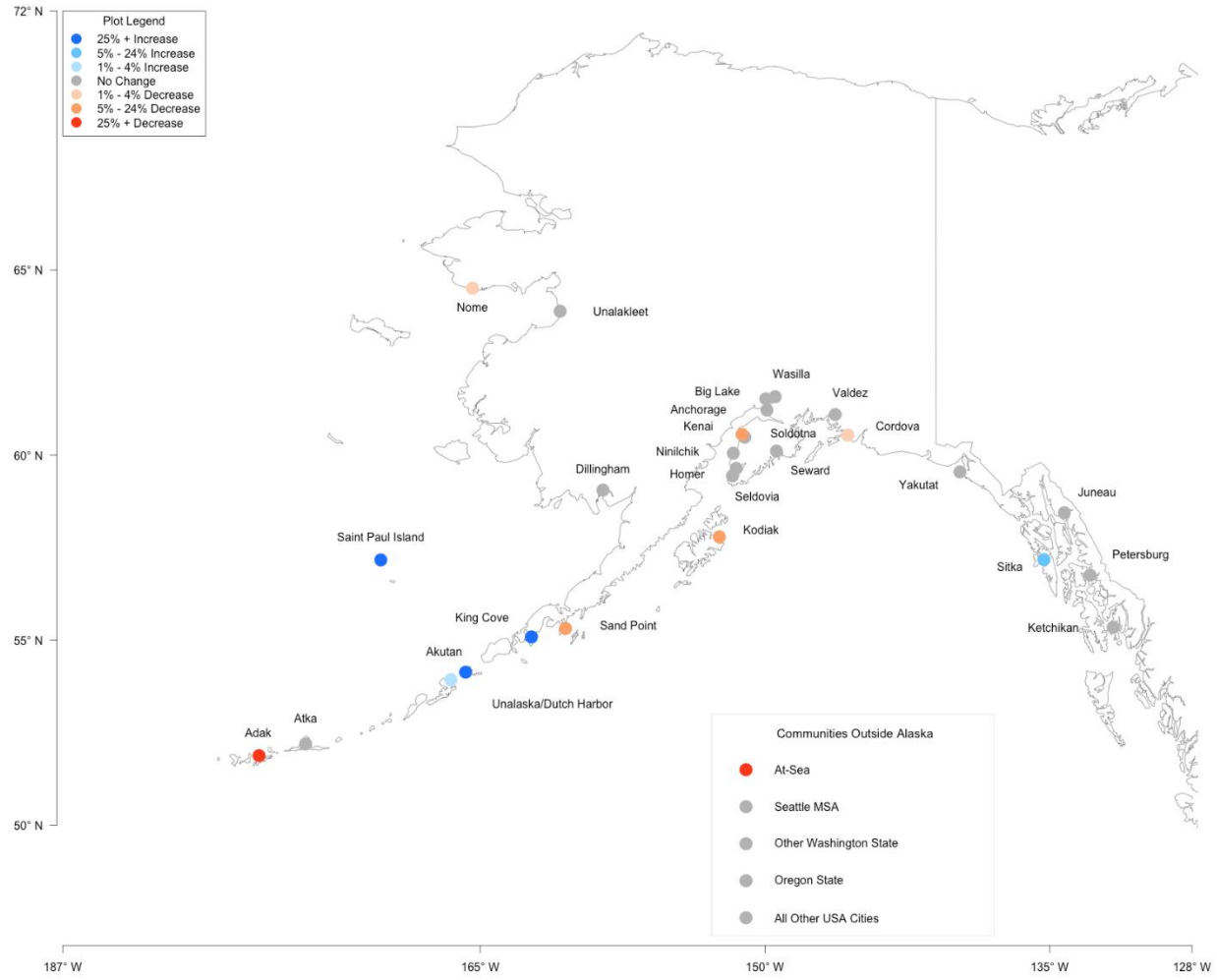

Figure 3. Percent change in processing engagement index (mean 1998/1999-2004/2005 to mean 2005/2006-2009/2010).

In the same vein, figure 4 displays the percentage change in the harvesting engagement index between the average of the pre-rationalization fishing seasons (1998/1999-2004/2005) to the average of the first five fishing seasons post rationalization (2005/2006-2009/2010). Percent change in CR crab harvester community engagement showed slight spatial trends, where nearby communities tended to have similar index changes. For example two nearby communities on the Kenai Penninsula, Homer and Seldovia, and both showed substantial increases in engagement. Similarly, the two westernmost communities in the Aleutian Islands, Adak and Atka, experienced no noticeable change in harvesting engagement. A notable exception was the diverging index scores of King Cove and Sand Point, which followed a similar pattern for both harvesting and processing engagement indices for the period. Other than Oregon, all regions in the continental US experienced moderate or

large decreases in harvester engagement. Three communities experienced a greater than 25% increase in harvesting engagement over this period, Anchorage, Homer, and Oregon communities, while five communities experienced declines in harvesting engagement of over 25% including All Other USA, Other Washington, Petersburg, Sand Point, and Sitka.

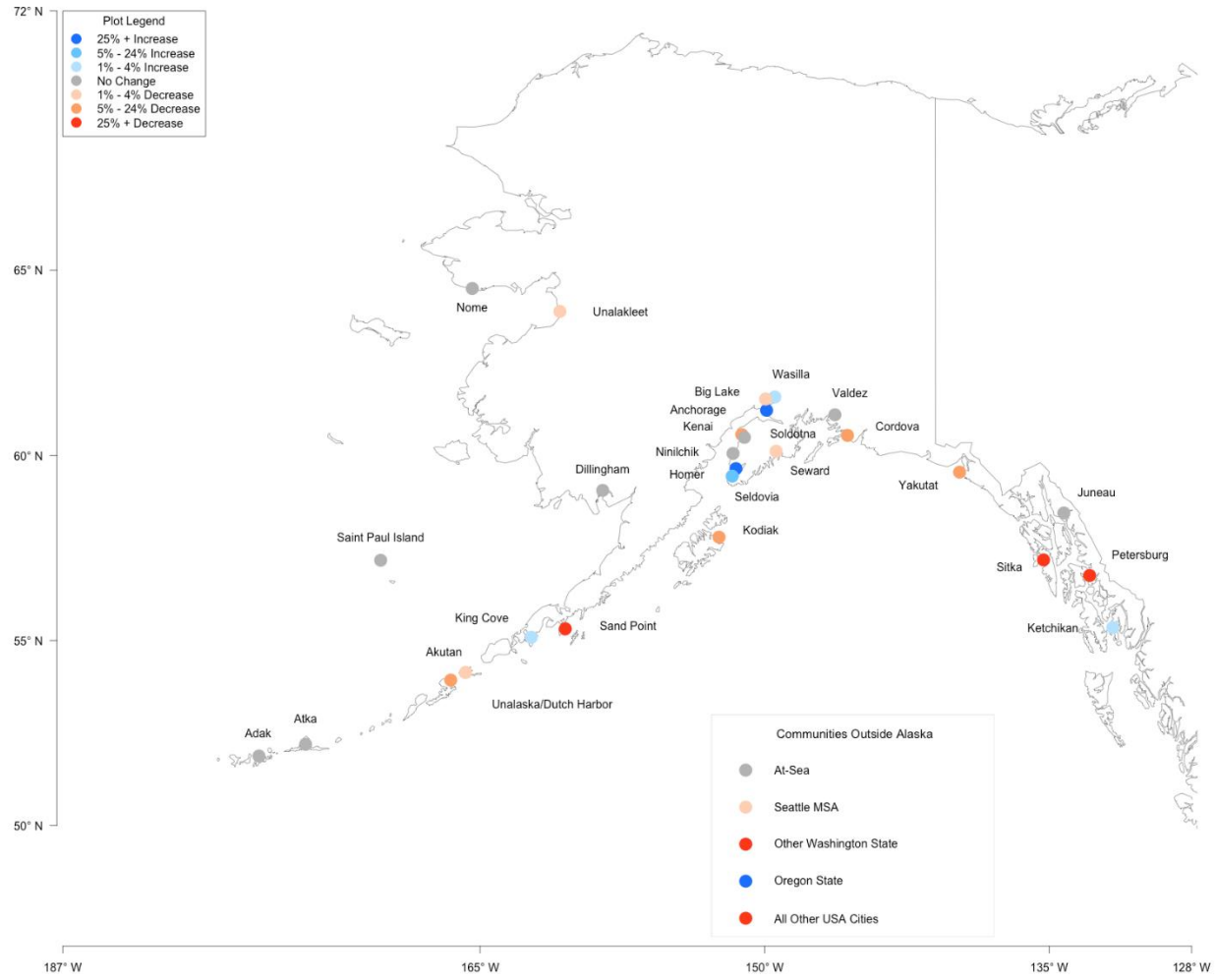

Figure 4. Percent change in harvesting engagement index (mean 1998/1999-2004/2005 to mean 2005/2006-2009/2010).

Comparison of the first five fishing seasons post-rationalization (2005/2006-2009/2010) with the second five year period post-rationalization (2010/2011-2014/2015)

Figure 5 displays the percentage change in the processing engagement index between the average of the first five fishing seasons post rationalization (2005/2006-2009/2010) and the second five year period post-rationalization (2010/2011-2014/2015). The majority of communities inside and outside Alaska did not see large changes in processor engagement over the time period. Notable exceptions included the At-Sea grouping and Aleutian Islands communities where only Sand Point and Atka indicated no change. There was little spatial trend among these communities. For example, Akutan experienced a large increase but Unalaska/Dutch Harbor saw a large decrease. Two communities experienced increases in processing engagement over these periods of over 25%, Akutan and Saint Paul, while only Kodiak experienced a decline of over 25% in processing engagement.

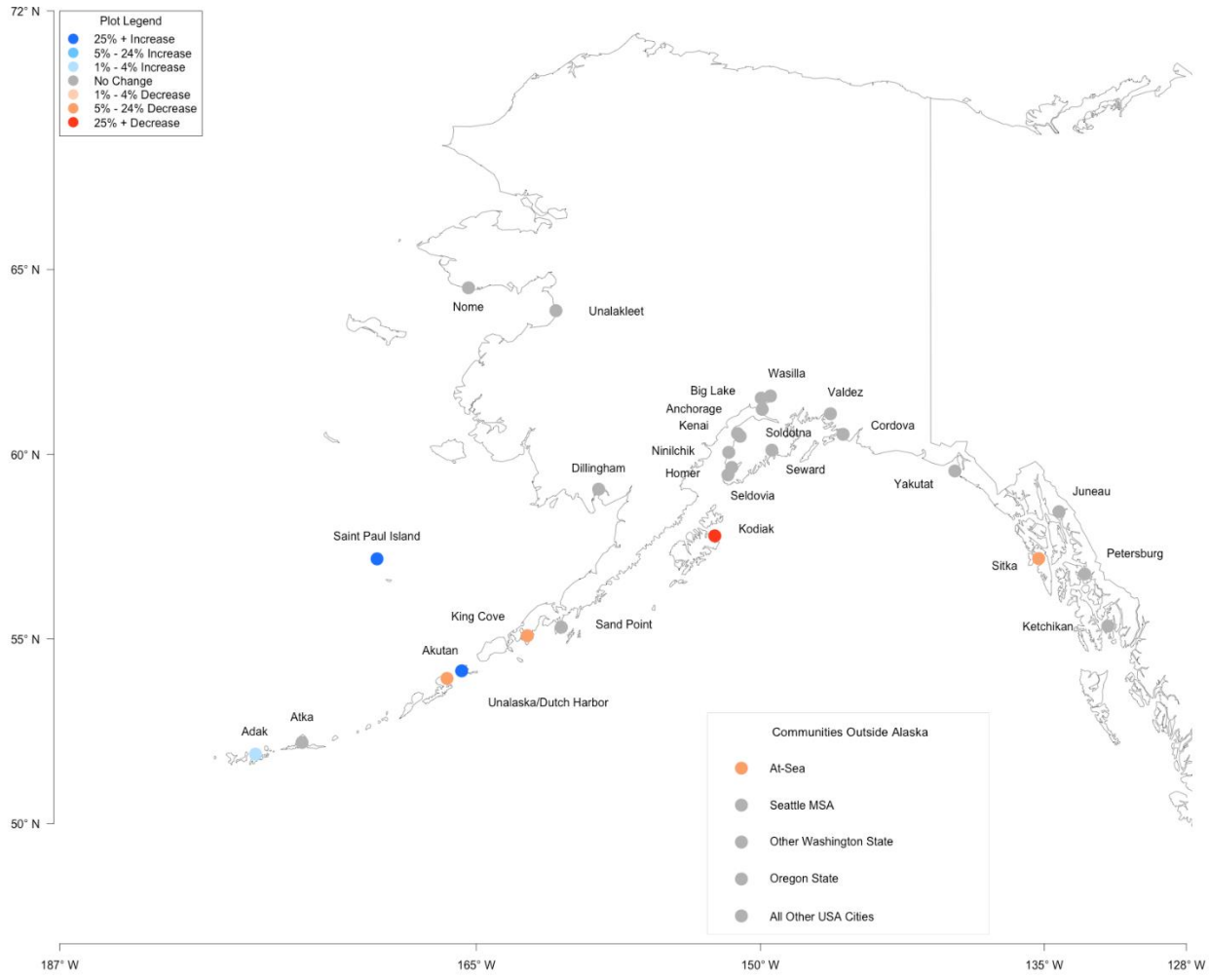

Figure 5. Percent change in processing engagement index (mean 2005/2006-2009/2010 to mean 2010/2011-2014/2015).

Figure 6 displays the percentage change in the harvesting engagement index between the average of the first five fishing seasons post rationalization (2005/2006-2009/2010) and the second five year period post-rationalization (2010/2011-2014/2015). Following rationalization, noticeable spatial trends emerged in the harvest engagement index. Many communities in the populous South Central Alaska region saw moderate or large increases. Other than the At-Sea grouping, all communities outside Alaska indicated large increases. Three communities experienced a greater than 25% increase in harvesting engagement over this period, Anchorage, Homer, and Washington state communities outside Seattle, while only King Cove experienced a decline in harvesting engagement of over 25%.

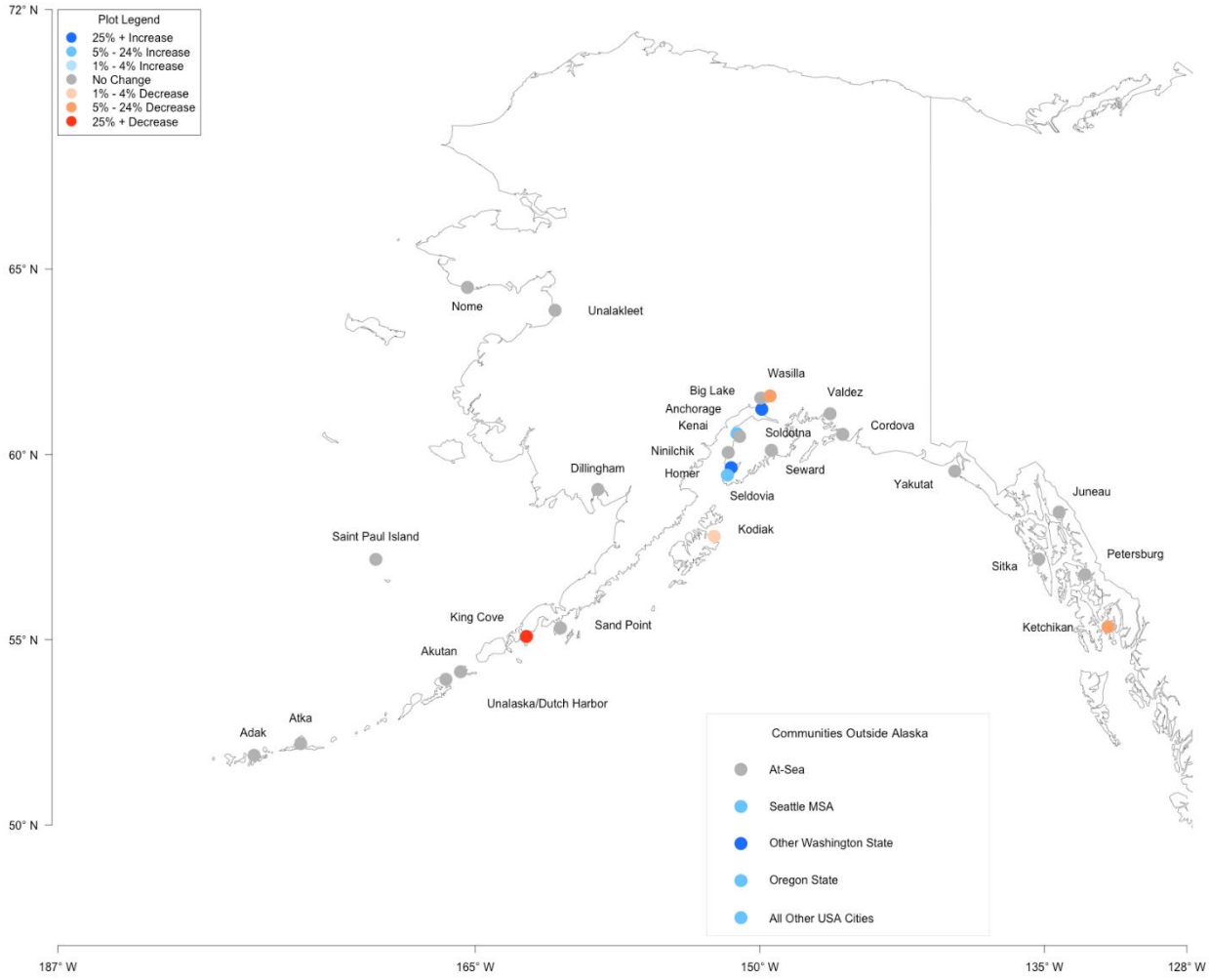

Figure 6. Percent change in harvesting engagement index (mean 2005/2006-2009/2010 to mean 2010/2011-2014/2015).

Comparison of pre-rationalization period (1998/1999-2004/2005) with the most recent five fishing seasons post-rationalization (2010/2011-2014/2015)

Figure 7 displays the percentage change in the processing engagement index between the average of the pre-rationalization fishing seasons (1998/1999-2004/2005) to the average of the second five fishing seasons post rationalization (2010/2011-2014/2015). This comparison highlights longer-term changes in community processing engagement. Few communities inside and outside Alaska experienced positive or negative changes in processing engagement during this time period. Contrasting the majority of Alaska, Aleutian communities showed moderate to large changes in processing engagement over the time period. Similar to above, neighboring communities tended to have diverging changes in processing. Where Akutan showed a large increase, nearby Unalaska/Dutch Harbor saw a slight decrease. Two communities experienced increases in processing engagement over these periods of over 25%, Akutan and Saint Paul, while three communities experienced a decline of over 25% in processing engagement including Adak, the At-Sea grouping, and Kodiak.

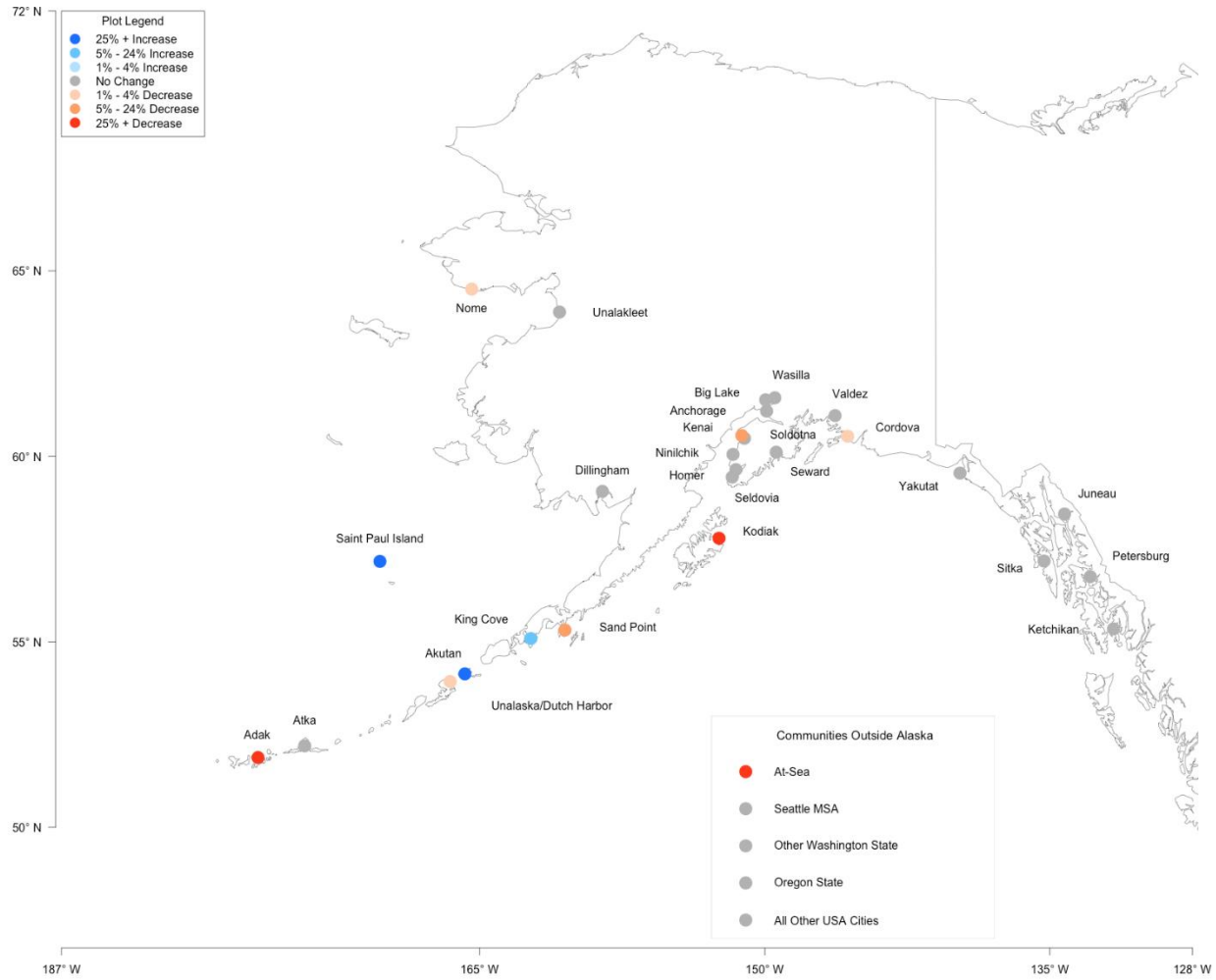

Figure 7. Percent change in processing engagement index (mean 1998/1999-2004/2005 to mean 2010/2011-2014/2015).

Figure 8 displays the percentage change in the harvesting engagement index between the average of the pre-rationalization fishing seasons (1998/1999-2004/2005) to the average of the second five fishing seasons post rationalization (2010/2011-2014/2015). This comparison highlights longer-term changes to community harvesting engagement. As Figure 8 indicates, there were regional trends in harvest engagement change over the longer-term. Southeast Alaska experienced large decreases in harvester engagement with the exception of Juneau. Similar decreases were experienced by Aleutian harvesting communities. South Central Alaska saw both increases and decreases. Communities outside of Alaska also indicate large increases or decreases in harvester engagement, with Seattle and Oregon communities seeing increases and Other Washington and Other USA cities seeing large decreases. Three communities experienced a greater than 25% increase in harvesting engagement over this period, Anchorage, Homer, and Oregon, while six communities experienced declines in harvesting engagement of over 25% including All Other USA, King Cove, Other Washington, Petersburg, Sand Point, and Sitka.

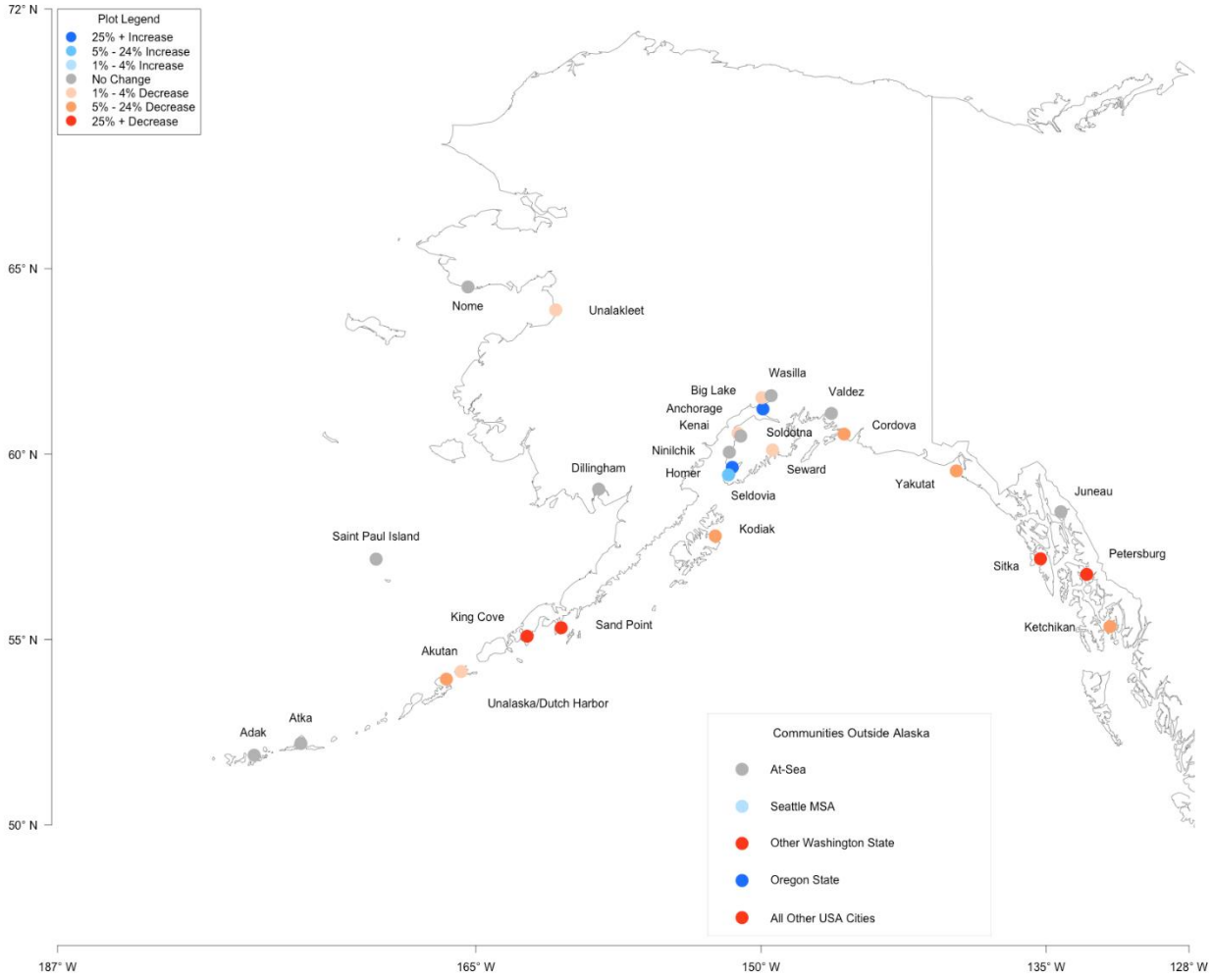

Figure 8. Percent change in harvesting engagement index (mean 1998/1999-2004/2005 to mean 2010/2011-2014/2015).

A total of three communities, Akutan, King Cove, and Saint Paul, experienced increases in their processing engagement index of over 25% between any of the three comparison periods (mean pre-rationalization to the mean of the first five years post-rationalization, the mean of the first five years post-rationalization to the mean of the second five years post rationalization, and mean pre-rationalization to the mean of the second five years post-rationalization). Figure 9 displays the full time series of their processing engagement indices from 1998/1999-2014/2015.

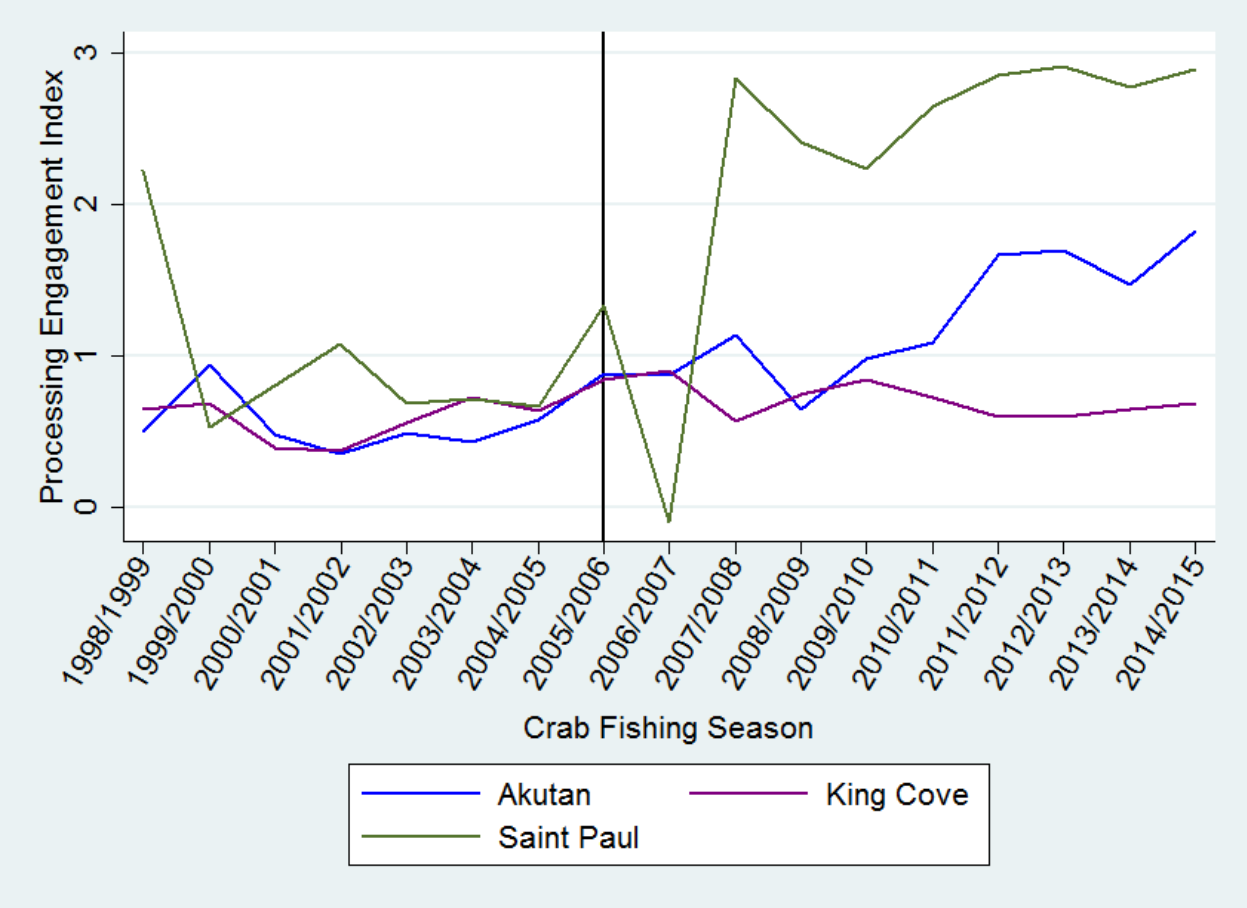

Figure 9: Communities with at least a 25% increase in processing engagement between any of the three comparison periods (mean pre-rationalization to the mean of the first five years post-rationalization, the mean of the first five years post-rationalization to the mean of the second five years post rationalization, and mean pre-rationalization to the mean of the second five years post-rationalization).

Three communities or groupings also experienced declines in their processing engagement indices of more than 25% between any of the three comparison periods above including Adak, the At-Sea grouping, and Kodiak. Figure 10 displays the full time series of their processing engagement indices from 1998/1999-2014/2015. While Adak experienced a substantial decrease in processing engagement after rationalization, it had a relatively small engagement in the fishery pre-rationalization.

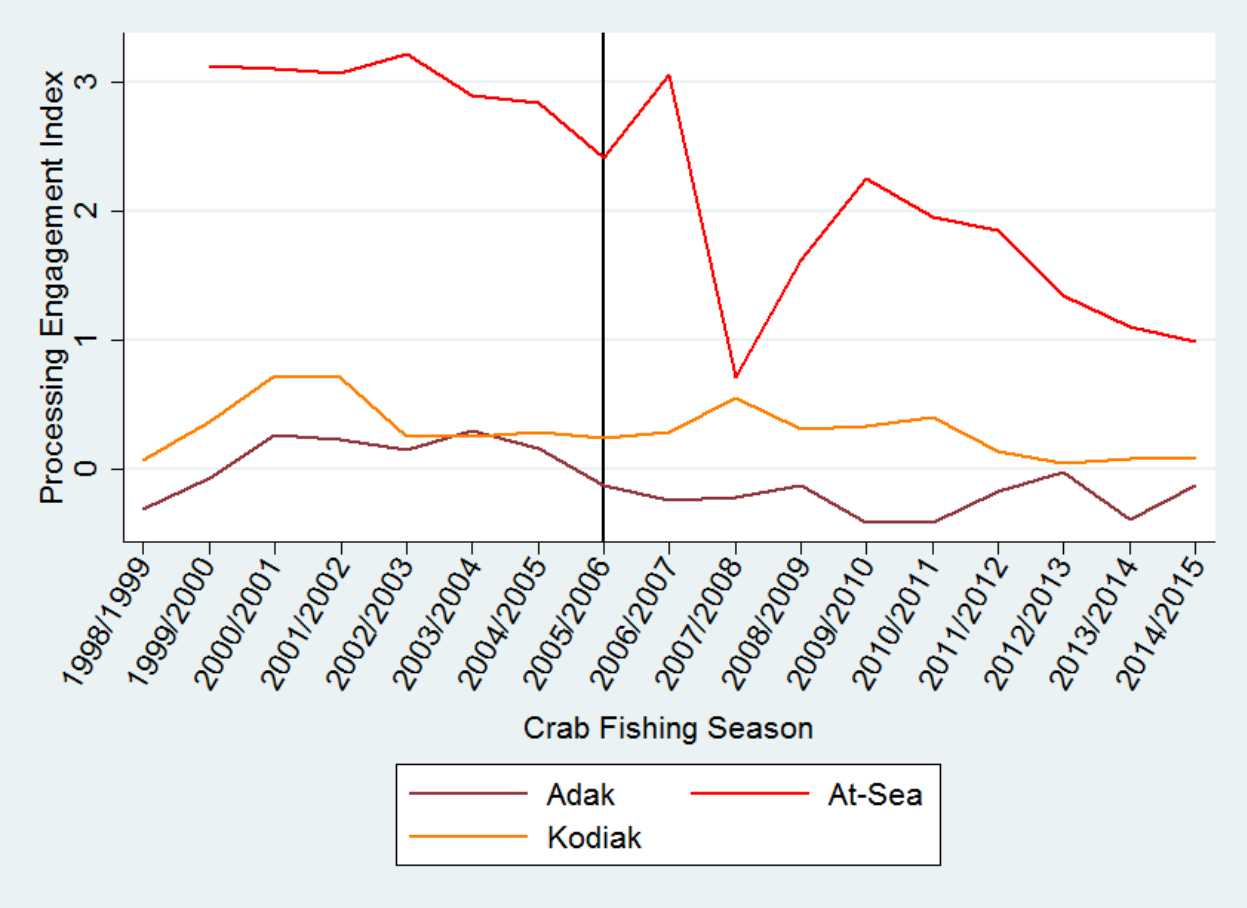

Figure 10: Communities with at least a 25% decrease in processing engagement between any of the three comparison periods (mean pre-rationalization to the mean of the first five years post-rationalization, the mean of the first five years post-rationalization to the mean of the second five years post rationalization, and mean pre-rationalization to the mean of the second five years post-rationalization).

Four communities experienced at least a 25% increase in their harvesting engagement indices over some of the comparison periods above, including Anchorage, Homer, Oregon, and Other Washington. Both Homer and Anchorage had low engagement in the CR crab fishery pre-rationalization but both increased substantially after rationalization with Anchorage becoming highly engaged in the CR crab fishery by the 2014/2015 fishing season. Figure 11 displays the full time series of all four community's harvesting engagement indices from 1998/1999-2014/2015.

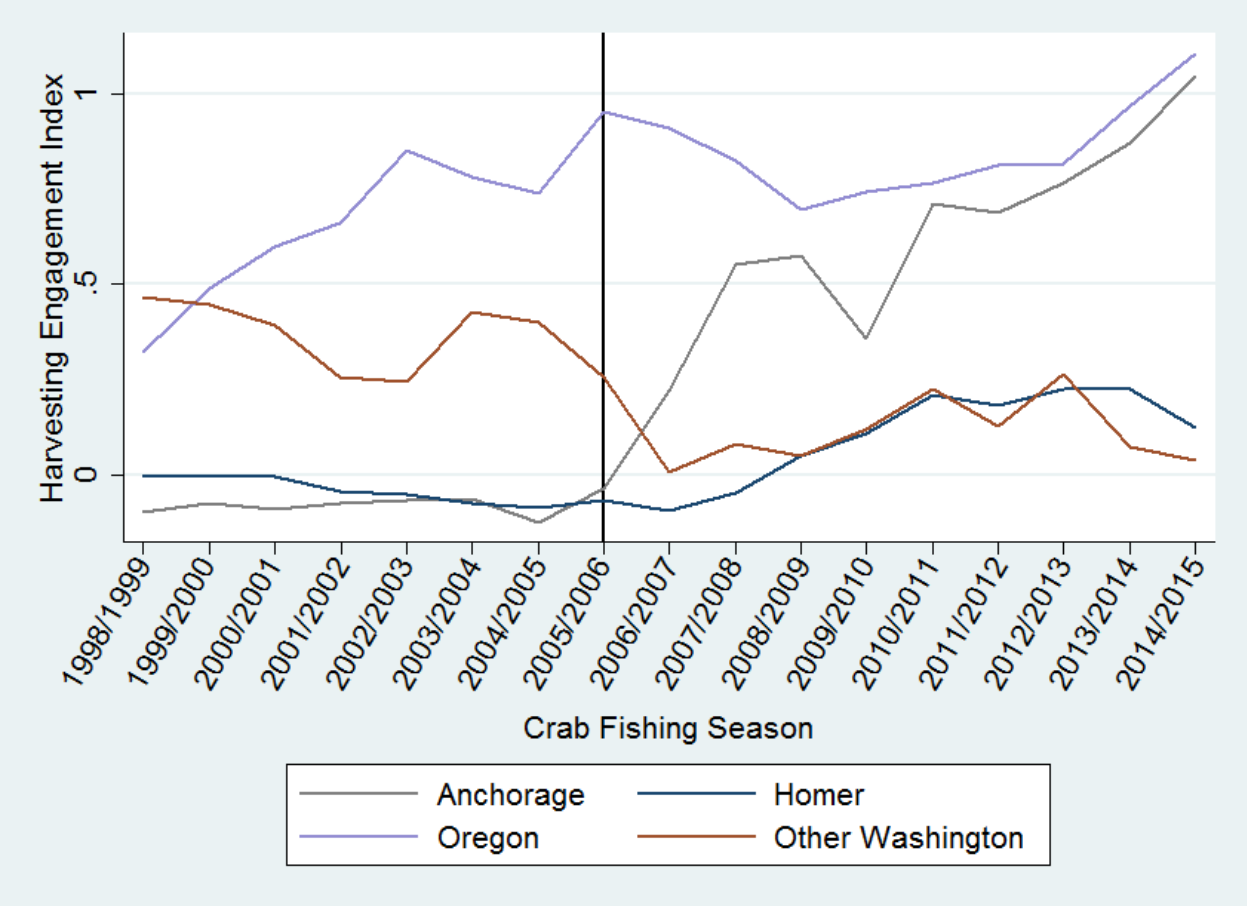

Figure 11: Communities with at least a 25% increase in harvesting engagement between any of the three comparison periods (mean pre-rationalization to the mean of the first five years post-rationalization, the mean of the first five years post-rationalization to the mean of the second five years post rationalization, and mean pre-rationalization to the mean of the second five years post-rationalization).

Six communities or groupings experienced declines in their harvesting engagement indices of more than 25% including All Other USA, King Cove, Other Washington, Petersburg, Sand Point, and Sitka. Figure 12 displays the full time series of their processing engagement indices from 1998/1999-2014/2015. Other Washington has experienced periods of larger than 25% increases and decreases in harvesting engagement (Figures 11 and 12), including a large 76% decline from pre-rationalization to the first five years post-rationalization and a more moderate 50% increase from that low level in the first five years post-rationalization to the second five years post-rationalization. With the exception of Other Washington, the other five communities all have mean average levels of engagement and sporadic involvement in the fisheries can cause significant increases and decreases in the percentage changes in these indices at such low levels.

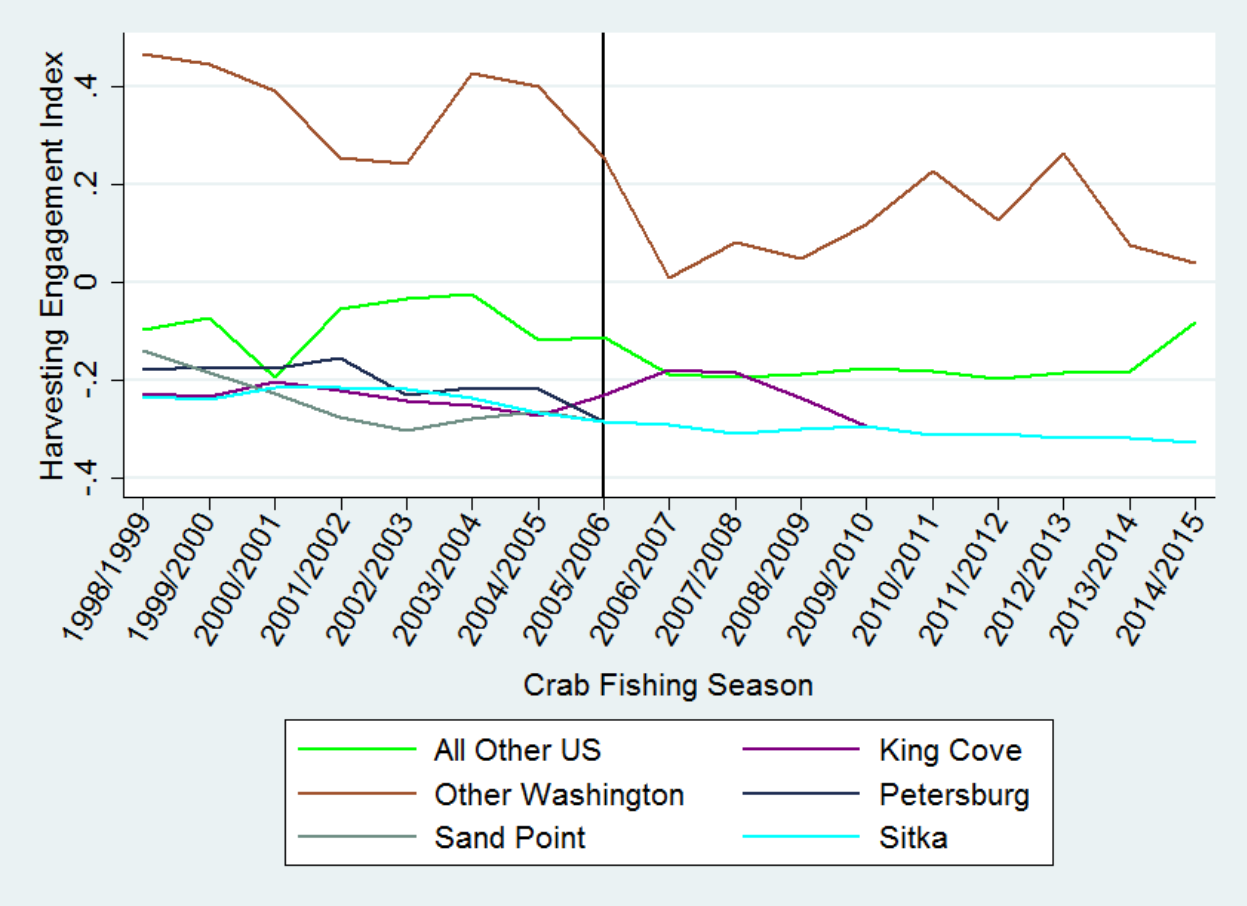

Figure 12: Communities with at least a 25% decrease in harvesting engagement between any of the three comparison periods (mean pre-rationalization to the mean of the first five years post-rationalization, the mean of the first five years post-rationalization to the mean of the second five years post rationalization, and mean pre-rationalization to the mean of the second five years post-rationalization).

Conclusion

This analysis creates quantitative indices of commercial processing and harvesting engagement for communities involved in the Crab Rationalization Program from the 1998/1999 fishing season through the 2014/2015 season. These quantitative indices are relative to all communities within a given fishing season and therefore do not measure absolute changes in processing or harvesting engagement. For example, while there was a large and significant decline in harvesting vessels in the fishing seasons following rationalization, if the distribution of those vessels exiting was proportional across all communities, these indices would show little or no change. However, what these indices do show is the changes in the relative position of harvesting communities away from many smaller Alaska communities toward larger

communities such as Anchorage, Homer, and to communities outside of Alaska. Furthermore, there were more changes in harvesting engagement than processing engagement over time, likely as a result of the harvester sector being more mobile than the processing sector.

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