

## Adapting to Environmental and Social Change: Subsistence in Three Aleutian Communities

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### Introduction

Our surroundings and society are both constantly evolving. Some changes are due to natural processes. People are responsible for other changes, because of what we do—for example, increasing the size of the population, expanding technology, and increasing mobility and connectivity. And some changes—like climate change—are due to a combination of natural processes and actions of people. In the Arctic, including the Aleutian Islands, marine and coastal ecosystems have seen the largest number of regime shifts with direct and indirect consequences for subsistence activities, commercial fisheries, and coastal communities (Council 2016). This paper describes current subsistence activities and changes local residents have observed over time in three Aleutian Island communities—Akutan, Nikolski, and Atka. As described more later, we did initial household surveys in 2016 and a second round in 2017, as well as more detailed interviews with some residents.

### Background

The Aleutians are an isolated group of islands extending 1,200 miles from southwest Alaska toward Russia (Figure 1). Indigenous residents of these islands are predominately Unangan (Aleut), but they are diverse.

Historically they spoke nine distinct dialects (Bergsland 2001), but today there are two main dialects. Residents of Atka and Attu speak the Western dialect and residents of Nikolski and Akutan, among others, speak the Eastern dialect (Collins et al. 1945). Unalaska/Dutch Harbor is the largest community, with a population of about 4,600, and it is one of the top seafood producers in the United States (NOAA 2015). The smaller places have populations ranging

from 22 in Nikolski to 626 permanent residents in Sand Point. (Sand Point, King Cove, and Akutan have fish processing plants, and counting plant workers inflates typical estimates of their populations.) For thousands of years residents of the Aleutians have lived off the bounty of the ocean for subsistence harvests, and also for commercial harvests since the arrival of outsiders. This area of Alaska was one of

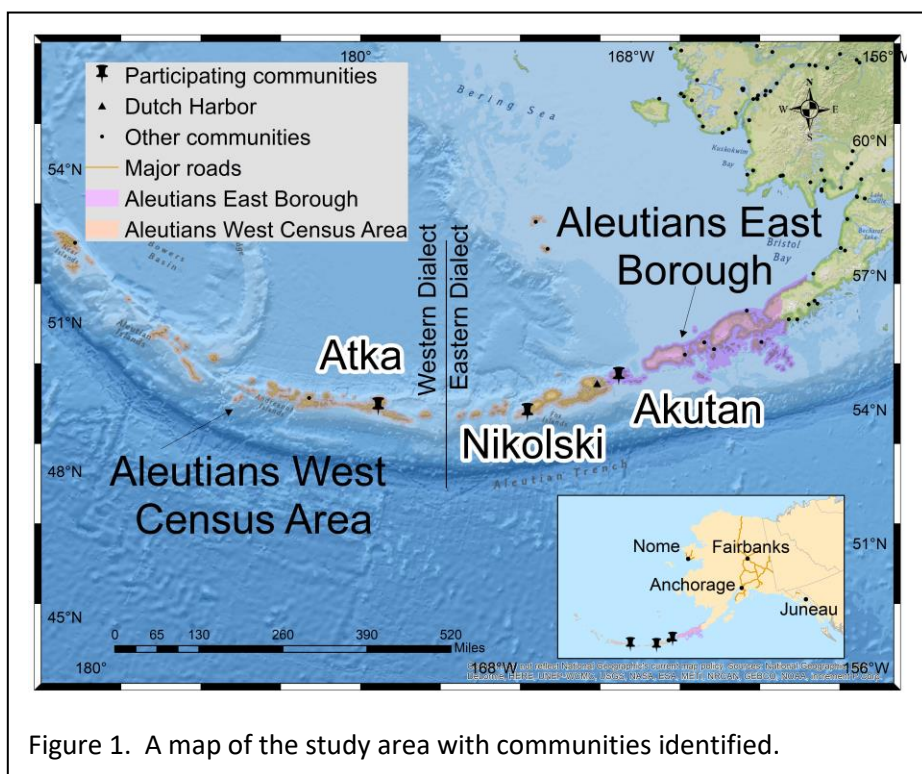


Figure 1. A map of the study area with communities identified.

the first to come in contact with outsiders—Russian fur traders in the 1700s—and thus the Aleut people have a long history with commercial harvesting (Reedy-Maschner 2010). But during World War II, many residents were forced to evacuate the islands, and the federal government sent them to internment camps in southeast Alaska. The entire original community of Atka was burned (U.S. Department of Health 1980). While the residents were gone, their villages were looted, the equipment they used for commercial and subsistence fishing was destroyed, and they lost continuity. Federal aid for re-building after the war was limited, and Aleutian residents were left at an extreme disadvantage for participating in commercial activities, compared with residents of other villages in southwest Alaska. That disadvantage has had lingering effects (Reedy-Maschner 2010).

In 2016 the population of the Aleutian Islands was nearly the same as it had been in 1980 (7,768 in 1980 and 8,483 in 2016); it had peaked in 1992 at 12,145 (U.S. Census 1980; AKLWD 2017). And most of that loss has been

from smaller communities, while Dutch Harbor continues to grow (Figure 2). All the communities we worked with have seen shrinking populations since the 1960s. Based on our research, the population of Akutan is 74 (2015), Nikolski 22 (2016), and Atka 44 (2015). The reported population of Akutan is often inflated, if the figures include

seasonal workers at the Trident Seafoods plant, who live in group quarters and have little interaction with the community

Residents of Akutan and Atka participate in commercial fishing, but those in Nikolski do not. The school in Nikolski closed in 2009, when enrollment fell below the state-required minimum of 10 students. But both other study communities are also close to this threshold.

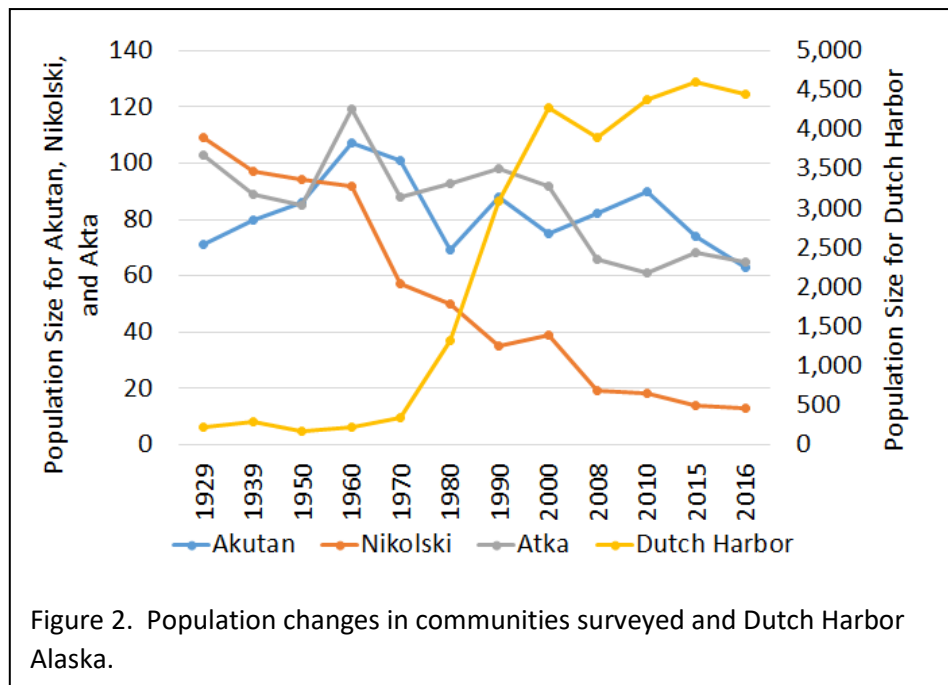


Figure 2. Population changes in communities surveyed and Dutch Harbor Alaska.

Table 1. Median household incomes for three Aleutian Island communities. Data from U.S. census, except for 2015/2016 which are from surveys conducted during this research.

	1990	2000	2010	2015/16
Akutan	\$65,817	\$48,719	\$49,622	\$48,072
Nikolski	\$75,568	\$55,937	\$23,818	\$42,072
Atka	\$60,333	\$44,660	\$129,918	\$64,144

Incomes in all three communities have been up and down since 1990, but in recent years income in Nikolski has been considerably below that in Akutan and Atka (Table 1). Instead of commercial fishing, Nikolski has a cattle ranch and lodge that provide local seasonal jobs (NOAA 2011).

Social and economic characteristics differ widely among the three communities, and have also changed substantially since the 1980s. Akutan has the most residents, as well as one of the largest fish processing plants in the world, operated by Trident Seafoods. Atka has a smaller plant, run by Atka Pride Seafoods and the Aleutian Pribilof Islands Development Association (APICDA). Using the Alaska Taxable database, maintained by the Alaska Division of Community and Regional Affairs, we calculated per capita fish tax revenue from 1991 through 2015. Akutan's revenues were magnitudes larger and still climbing, unlike those of Atka or the Aleutians East Borough (Figure 3). In 2003 Atka raised its fish tax from 1% to 2%, and in 2013 Akutan raised its fish tax from 1.0% to 1.5%.

Besides local tax revenues, the processing plants provide other services, especially in Akutan. For example, Trident built a community recreation center, and allowed residents to use its garbage incinerator when the

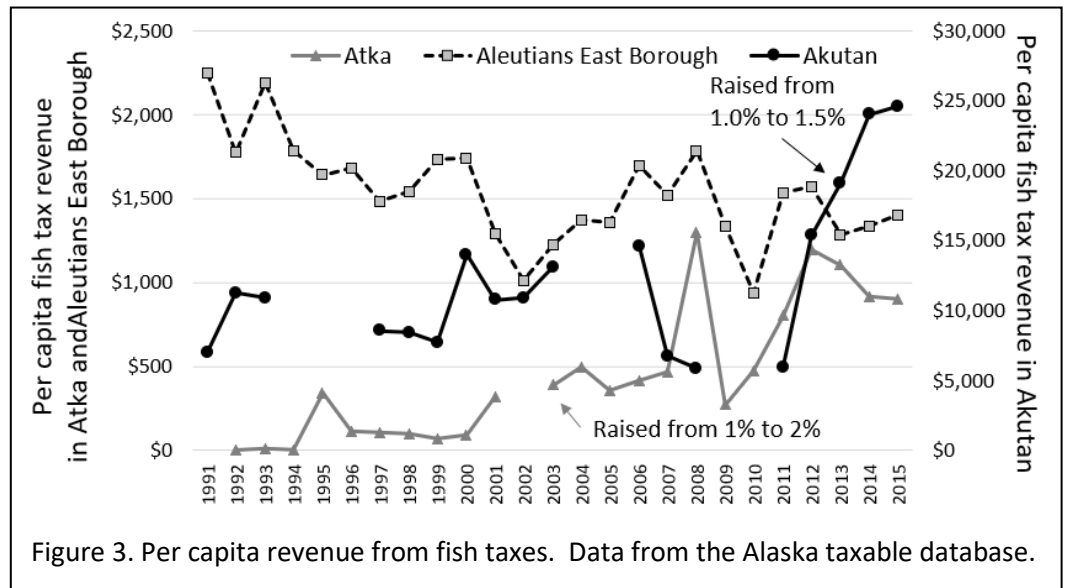


Figure 3. Per capita revenue from fish taxes. Data from the Alaska taxable database.

community's broke down. It has also provided financial support for various other local activities.

The maritime climate in the Aleutians influences all aspects of life. The weather is known to be harsh, and in combination with the remoteness of the region, getting to the villages can be difficult. Historically temperatures typically ranged between 30° F and 50° F. Yearly and decadal fluctuations are influenced by large-scale climate regimes like the Pacific Decadal Oscillation (PDO), Aleutian Low, and Niño events (Rodionov et al. 2005). Temperatures are increasing in all three communities except for winter (November, December, and January). There is an east to west gradient in warming with eastern communities are warming more than western (Figure 4a). For example, the Aleutian Low switched from weak to strong in the late 1970s, and temperatures changed dramatically (Figure 4b). Precipitation varies widely, but temperature and precipitation data indicate that temperatures have increased since 1990—and more rain now occurs around Akutan and less around Atka (Figure 4a). Temperatures are projected to keep rising (Figure 4b).

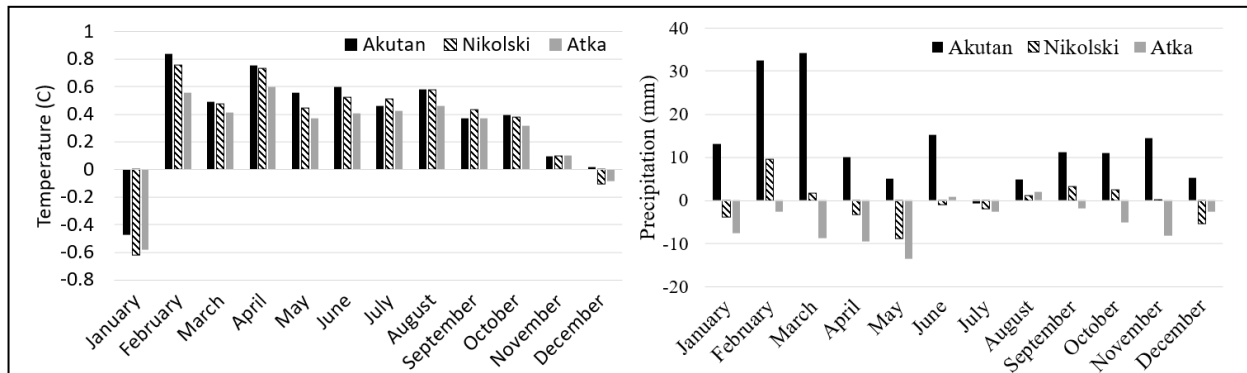


Figure 4a. Changes in climate in Akutan, Nikolski, and Atka between 1990-2009 and 1950-1989. Data from a downscaled climate research unit (CRU) data available at SNAP. <https://www.snap.uaf.edu/methods/data>

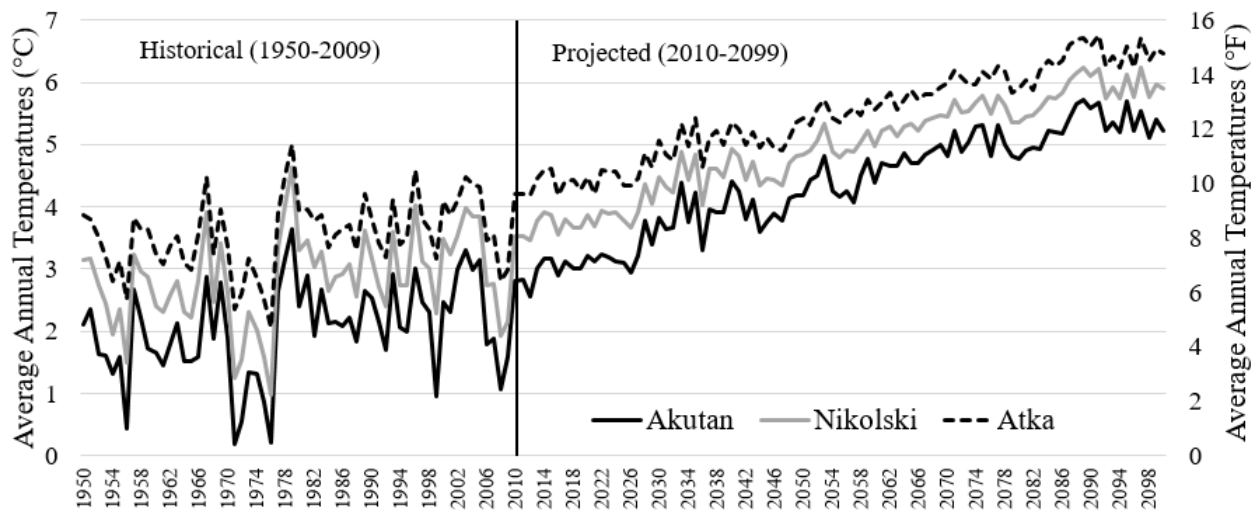


Figure 4b. Average annual temperature in Akutan, Nikolski, and Atka with historical data from 1950 through 2009 and projections from 2010 through 2099. Future data is an average of five general circulation models (771 m). For more detail see: <http://ckan.snap.uaf.edu/dataset/projected-monthly-and-derived-temperature-products-771m-cmip5-ar5>.

### Research Methods

We surveyed households in Akutan, Atka, and Nikolski in 2016 and 2017. Populations in Akutan (74) and Nikolski (22) did not change greatly during that time, but a few people left Atka (44) during 2016. In 2016 we asked respondents about their 2015 subsistence harvests, and in 2017 we asked about their 2016 harvests.

In April 2016, we conducted household surveys in Akutan (n= 26, 70% of households) and Atka (n = 16, 74%). In addition, we conducted key respondent interviews with eight people selected from the household interview respondents, to provide more insight into values and changes they had observed in their communities over their lifetime. Due to bad weather we were not able to travel to Nikolski in 2016. However, we interviewed three Nikolski residents in May 2016, when they came to Anchorage for meetings, collecting data on three households; we also received two mail surveys (n = 5, 50%). We

conducted a second round of subsistence harvest surveys during May 2017 in Akutan (n= 24, 63%), Atka (n= 16, 80%), and Nikolski (n= 9, 90%). During our return trip in May we also held community meetings to present the results from the previous year, to correct potential errors and get feedback. We also showed participants areas where community residents said they had previously taken subsistence harvests but did not in 2015, and asked the reasons why. For our analysis we used both years of data—reported harvests in 2015 and 2016—unless otherwise noted.

## Results

### *Current and past subsistence harvests*

The per-capita harvest by year-round residents in our study period was largest in Atka (755 pounds) followed by that in Nikolski (646 pounds) and that in Akutan (439 pounds). Atka, the community the farthest out in the Aleutian chain, also harvested the largest total pounds of subsistence food, even though it is smaller than Akutan. Figure 5 shows the breakdown, based on total pounds harvested, in each community during 2015 and 2016.

Fish—primarily salmon but also including halibut and cod—made up 76% of the major subsistence resources harvested in Akutan during the study period and 62% in Nikolski. An extremely strong pink run in Akutan in 2015 resulted in more pink salmon being harvested than red (sockeye), which were more common in the other two communities. According to one Akutan resident, “the bay was rolling with pinks.” In Akutan, residents often set up their nets in the bay near the community, so harvests depend heavily on which species of fish is running. In Atka, by contrast, salmon, halibut, cod, etc. made up just 35% of the major resources harvested during the study period.

Cattle and reindeer are not native to the Aleutians, but were introduced there. These feral animals make up a significant share of the major subsistence resources in Nikolski and Atka. In Nikolski, cattle accounted for 20% of the harvest and feral reindeer 8%. Cattle frequently pass through Nikolski from a nearby ranch, and local hunters process the meat and distribute it throughout the community. Cattle are on an island (Akun) adjacent to Akutan, and made up 9% of the Akutan harvest. Several residents told us that the beef is not preferred food in Akutan, and mentioned trading beef with nearby communities for reindeer meat. On Atka, feral reindeer made up 25% of the main harvest and cattle 7%. Cattle are not present in Atka, but they were harvested while a resident was visiting Nikolski. Sharing feral animals is common among communities in the Aleutians and with other areas of Alaska (Reedy and Maschner).

Marine mammals made up nearly a third of the major subsistence resources harvested in Atka—Stellar sea lions 22% and harbor seals 7%. Sea lions accounted for just 4% in Akutan of the harvest and in Nikolski the harvest was only 2% of the total harvest by weight. Only in Nikolski did birds, geese specifically, make up any of the major subsistence harvest—3%—and only in Akutan was the harvest of berries a major source by weight (5%).

The lower right graph in Figure 5 shows differences in the average number of species households in the study communities tried to harvest, did harvest, used, gave away, and received in recent years. In all categories, Atka ranked the highest. Akutan was lowest in attempts, harvests, and use, while Nikolski was slightly lower than the others in giving away subsistence foods.

We can't report how the average number of species harvested and used during the study period compares with average numbers of species harvested and used in all three communities in earlier years.



estimated pounds of salmon residents of Akutan harvested varied from a low of about 1,000 to more than 18,000 estimated pounds of fish. In most years sockeye accounted for most of the salmon harvest, but in 2015 there was an especially big run of pinks (as we noted earlier). In Nikolski, harvests between 1991 and 2016 were also up and down, with a very small harvest in 2003 and more than 8,000 pounds in 2015. Silvers (cohos) were a larger part of the harvest in most years in Nikolski than in Akutan. The same up-and-down pattern was true in Atka, with reds, pinks, and silvers (cohos) making up most of the harvest over the years and dog and king salmon very little.

How have changing harvests of salmon and other fish affected the balance of the subsistence harvests in the study communities over time? In Akutan, fish have become a more dominant part of the subsistence harvest, with fish making up 76% in our study period. That was up from 69% in 2008 and 57% in 1990 (Fall et al. 2012, CSIS 2017). Most of that change was due to increased salmon harvests, which in 1990 were only 26% of the overall pounds harvested in Akutan, but increased to 45% in 2008 and were at 54% in 2015 and 46% in 2016.

The percentage of the harvest that is fish also increased in Nikolski, from half in earlier years to 66% in the study period. But feral animals—cattle and reindeer—also made up a growing share of the harvest, from 27% in 1990 (CSIS 2017) to 31% in our study period. By contrast, in Atka, the percentage of the harvest that is fish decreased from 41% in 1994 to 34% in the study period. But as was true in Nikolski, feral animals made up a bigger share of the Atka harvest, up from 21% in 1994 to 34% in our study period (CSIS 2017).

A big change is that only in Atka did marine mammals make up a large portion of the subsistence food harvested (32%) in recent years, compared with 4% in Akutan and a very small harvest in Nikolski. In 1990, marine mammals made up 20% to 23% of the harvested weight in the study communities (CSIS 2017).

Figure 7 compares the per capita harvests in the study communities in 2015 and 2016 with those of several communities in southwest Alaska in recent years and with the average for the Southwest-Aleutians region in 2014. Harvests in all three study communities were above the regional average of about 200 pounds per person, and above the averages in Togiak and Nelson Lagoon. The averages in Nikolski and Atka were also higher than the averages in all the comparison communities.

It's important to keep in mind that in rural Alaska it is common for some households (often called super households) to harvest a large amount and share it with other community members (Wolfe and Walker 1987). These high-harvesting households are extremely important for food security and for preserving local knowledge. There is earlier data about high-harvesters only for Akutan; the number of households harvesting 70% of the subsistence foods by weight in Akutan increased from 4 of 36 households in 2008 to 6 of 26 household in 2015 (Fall et al. 2012). However, when subsistence harvests during commercial fishing are not included this decreases to a single household. Subsistence harvests while commercial fishing help distribute the harvest among households. Meanwhile 33% (n = 5) and 19% (n = 3) of the households in Atka and Nikolski, respectively, harvested 70% of the communities resources by weight.

In our study period, all three communities had a large gap between the highest and next highest harvesting household. That gap was the greatest in Atka, with the highest household harvesting 30% of resources in 2015 and the second highest household harvesting 19%. In Nikolski, the highest-harvesting



household took 36% of the total community harvest in 2016, while the second-highest took 23%. In Akutan, the highest harvesting household took 27% of the community harvest in 2015, compared with 16% for the second. Because we were not able to interview all households, these results should be viewed with caution. In 2017 we interviewed all but one household in Nikolski and in 2016 half the households in that community. But the one household we were not able to interview in 2017 had reported subsistence harvests in 2016 via a mail survey, and it was a high-harvesting household. Most of the respondents from 2016 were high harvesting households, so the 2016 estimated harvests for Nikolski may be biased upwards. Regardless of that stipulation, per capita harvests in Atka and Nikolski were larger than in Akutan during the study period.

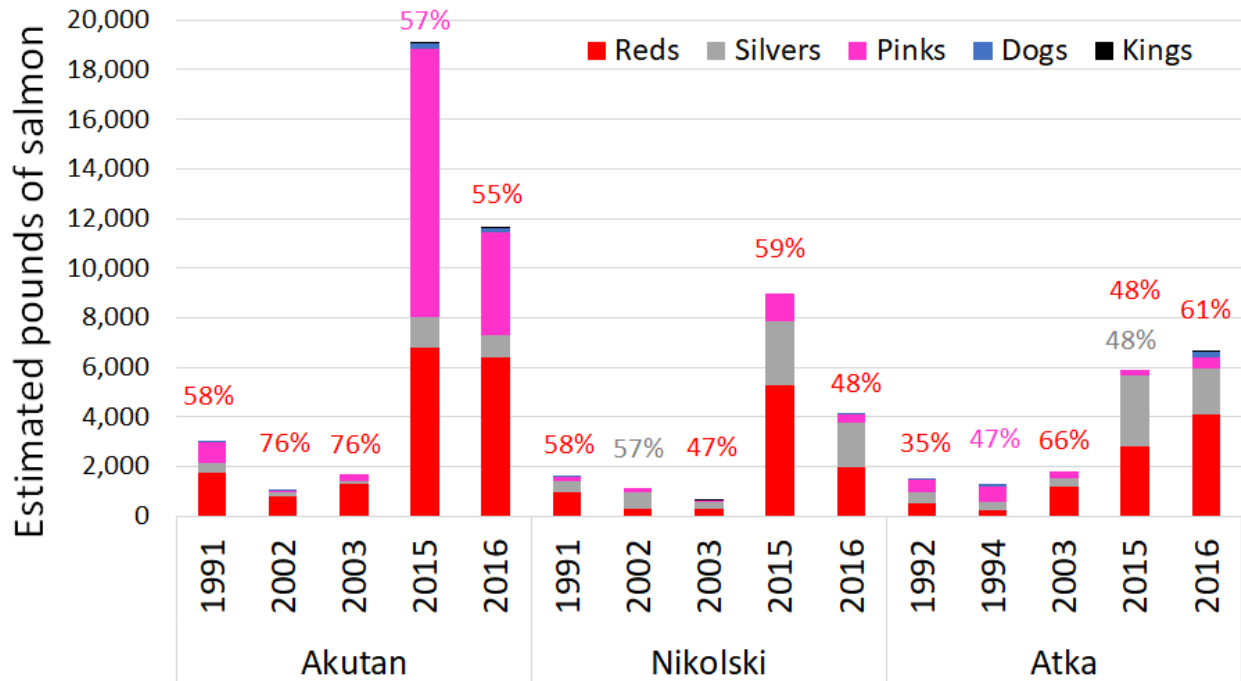


Figure 6. Estimated pounds of salmon harvested by species in three Aleutian Island communities. Percentages noted are for the dominant species in a given year and represent the percentage of that type of salmon among all species harvested. Data from 1990s and early 2000s is from Davis 2005, and 2015 and 2016 are from this research.



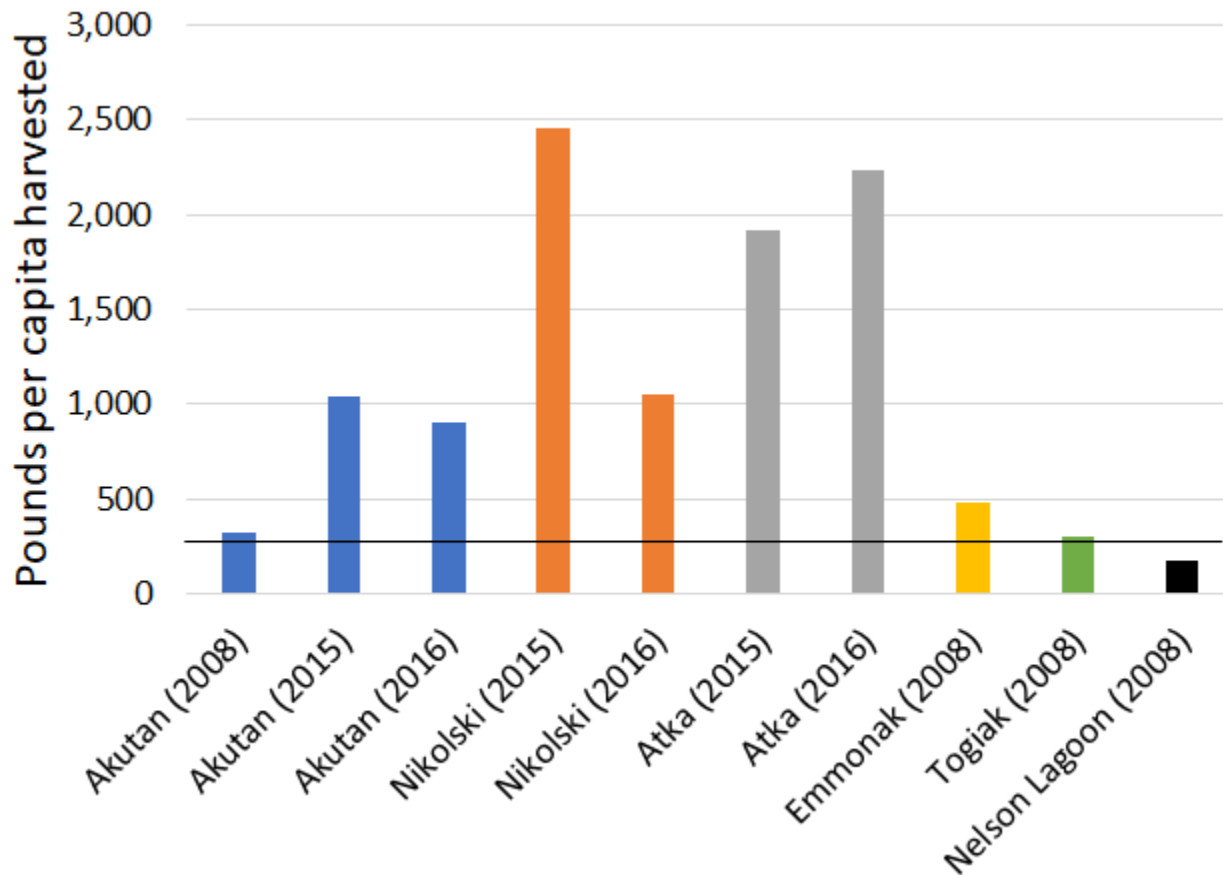


Figure 7. Per capita harvests for study communities are from this research and others are from ADFG 2014. Average per capita harvest for the Southwest-Aleutians is 206 pounds per capita (ADFG 2014).

Table 2 shows us that even though harvests of some species have declined over the years, almost all households in the study communities harvested, used, and shared subsistence resources in 2015 and 2016. Fish, especially salmon, and berries are the two most commonly harvested resources, but fish are more likely to be shared than berries. And even though the percentage of households harvesting marine mammals and bird eggs is the lowest in Akutan, sharing was extremely high—so that nearly all households in that community got and used those resources. Clearly, this is a way people who can get out and harvest resources help those who can't. Nikolski is the smallest community, and it had the lowest percentage of households that reported receiving subsistence foods. There is food-sharing, but it's not as widespread as in Akutan and Atka.

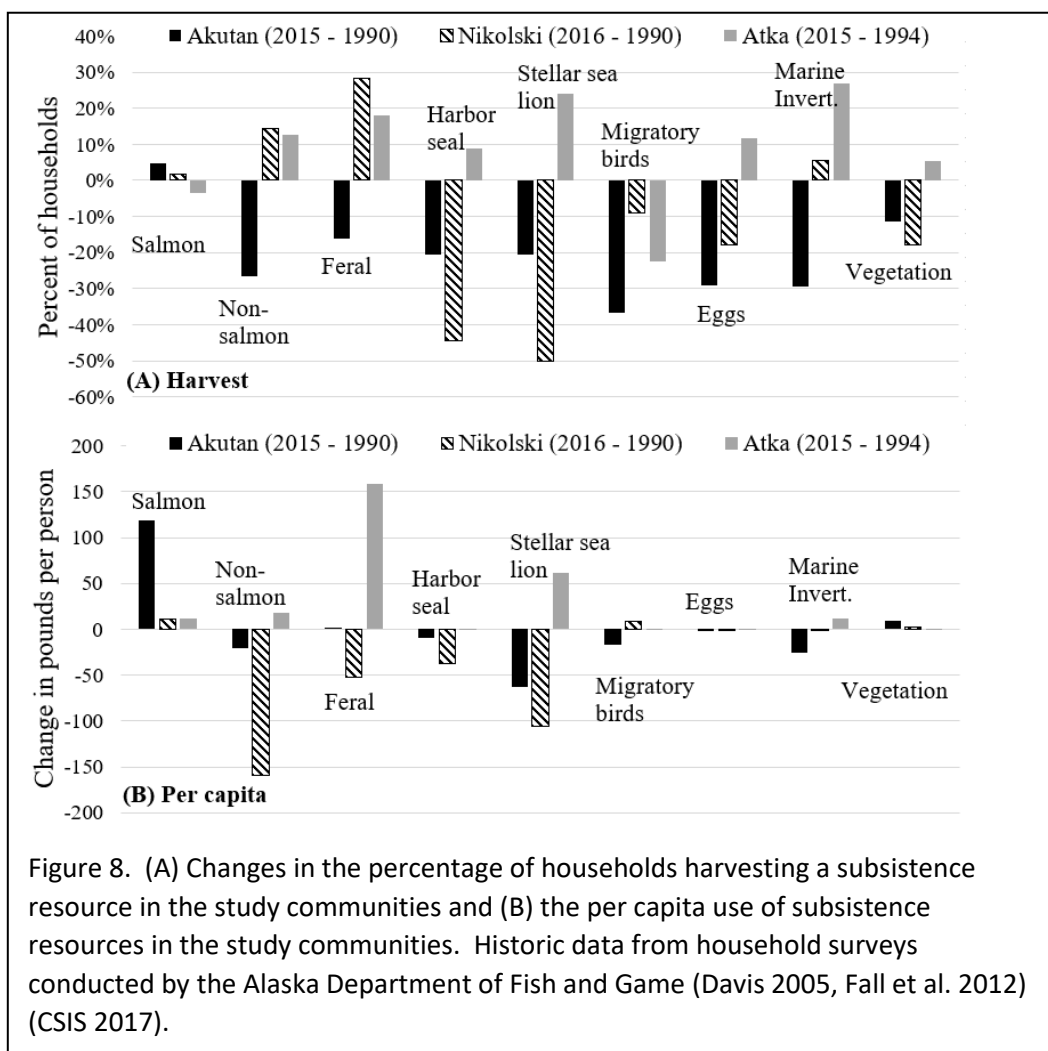
Table 2. Average percentage of year-round resident households that attempt, harvest, use, and share subsistence foods in Akutan, Nikolski, and Atka, 2015 and 2016.

Community	Resource	Attempt	Harvest	Use	Give	Receive
<b>Akutan</b>	All	98.1%	98.1%	100.0%	98.1%	95.6%
	Fish	75.0%	75.0%	86.5%	78.8%	67.3%
	Salmon	69.6%	71.7%	97.8%	78.3%	63.0%
	Non-salmon	73.9%	67.4%	93.5%	63.0%	52.2%

Community	Resource	Attempt	Harvest	Use	Give	Receive
<b>Nikolski</b>	Marine mammals	17.3%	13.5%	55.8%	55.8%	17.3%
	Sea Lion	8.7%	10.9%	43.5%	45.7%	13.0%
	Seal	19.6%	13.0%	56.5%	56.5%	17.4%
	Marine invertebrates	30.8%	30.8%	75.0%	57.7%	38.5%
	Land mammals	7.7%	5.8%	48.1%	44.2%	13.5%
	Birds and eggs	34.6%	32.7%	63.5%	48.1%	26.9%
	Migratory birds	19.6%	19.6%	32.6%	15.2%	15.2%
	Bird eggs	30.4%	28.3%	65.2%	52.2%	23.9%
	Vegetation	80.8%	78.8%	80.8%	38.5%	38.5%
	Berries	91.3%	87.0%	91.3%	43.5%	43.5%
	Other plants	23.9%	23.9%	23.9%	2.2%	6.5%
	All	100.0%	100.0%	100.0%	100.0%	100.0%
	Fish	100.0%	100.0%	100.0%	67.5%	90.0%
	Salmon	92.3%	92.3%	100.0%	46.2%	61.5%
	Non-salmon	92.3%	92.3%	100.0%	61.5%	76.9%
	Marine mammals	28.8%	16.3%	55.0%	38.8%	16.3%
	Sea Lion	15.4%	7.7%	23.1%	7.7%	7.7%
	Seal	30.8%	15.4%	46.2%	30.8%	15.4%
	Marine invertebrates	47.5%	41.3%	57.5%	35.0%	25.0%
	Land mammals	71.3%	65.0%	100.0%	71.3%	52.5%
	Birds and eggs	61.3%	61.3%	83.8%	38.8%	61.3%
	Migratory birds	61.5%	61.5%	84.6%	38.5%	38.5%
	Bird eggs	46.2%	38.5%	69.2%	30.8%	53.8%
Vegetation	87.5%	87.5%	87.5%	28.8%	58.8%	
Berries	76.9%	76.9%	76.9%	30.8%	38.5%	
Other plants	7.7%	7.7%	7.7%	0.0%	7.7%	
<b>Atka</b>	All	96.9%	96.9%	100.0%	96.7%	77.3%
	Fish	84.4%	84.4%	96.9%	87.5%	62.5%
	Salmon	80.6%	77.4%	100.0%	83.9%	58.1%
	Non-salmon	87.1%	87.1%	100.0%	74.2%	58.1%
	Marine mammals	71.9%	65.6%	96.9%	84.4%	56.3%
	Sea Lion	58.1%	51.6%	90.3%	77.4%	48.4%
	Seal	71.0%	54.8%	96.8%	77.4%	51.6%
	Marine invertebrates	78.1%	78.1%	93.8%	62.5%	53.1%
	Land mammals	71.9%	71.9%	96.9%	90.6%	50.0%
	Birds and eggs	59.4%	59.4%	81.3%	65.6%	43.8%
	Migratory birds	41.9%	35.5%	58.1%	41.9%	19.4%

Community	Resource	Attempt	Harvest	Use	Give	Receive
	Bird eggs	48.4%	48.4%	74.2%	48.4%	29.0%
	Vegetation	87.5%	87.5%	87.5%	40.6%	34.4%
	Berries	64.5%	61.3%	67.7%	29.0%	9.7%
	Other plants	83.9%	80.6%	87.1%	22.6%	25.8%

Figure 8 shows how the percentages of households harvesting various species, and the per capita harvests, in the study communities changed between the 1990s and 2015 or 2016. In Akutan, the percentage of households harvesting subsistence resources declined for all resources except salmon. While salmon harvests have increased, harvests of marine mammals (harbor seals and Stellar sea lions) decreased by 78.8% (14.5 pounds in 2015 vs 67.8 in the 1990s), and in Nikolski dropped 37.8% (26.2 pounds in 2015 vs 42.1 lbs. in 1990 (Wolfe and Mishler 1995, Wolfe et al. 2009). Some reasons given for the decline in marine invertebrates was the fear of paralytic shellfish poisoning, which seems to be more common in the Aleutians or at least on peoples' minds.



The biggest decrease was in harvests of Stellar sea lions, with Nikolski in the 1990s harvesting 48 animals and none in 2016, as Figure 9 shows. That figure indicates that harvests and use of harbor seals and Stellar sea lions decreased in all three communities in the early 2000s, but then rebounded in Atka. Harbor seal harvests and use slightly rebounded in Nikolski, but not in Akutan, where the number of Stellar sea lions harvested decreased by half, from 31 in the 1990s to 15 in 2015. Overall the percentage of households that harvested marine mammals in Akutan decreased by nearly half between 2008 and

2015, from 28% to 15%. By contrast, residents of Atka harvested more than double the pounds of marine mammals in 2015 as in the 1990s (194.8 pounds per capita versus 72.4).

But a point to keep in mind is that harvests of marine mammals may be complicated by regulations and listing of the Steller sea lion on the Endangered Species list. The Western population, which occurs in the Aleutians, was listed as endangered in 1997. The Endangered Species Act does include a subsistence exemption, but the listing is still acknowledgement that the species is in danger of extinction throughout all or a significant portion of its range. This listing could persuade people to reduce or stop harvesting the sea lions, even if they still have the legal right to do so. Harvests did decline sharply around 1997 (Figure 9).

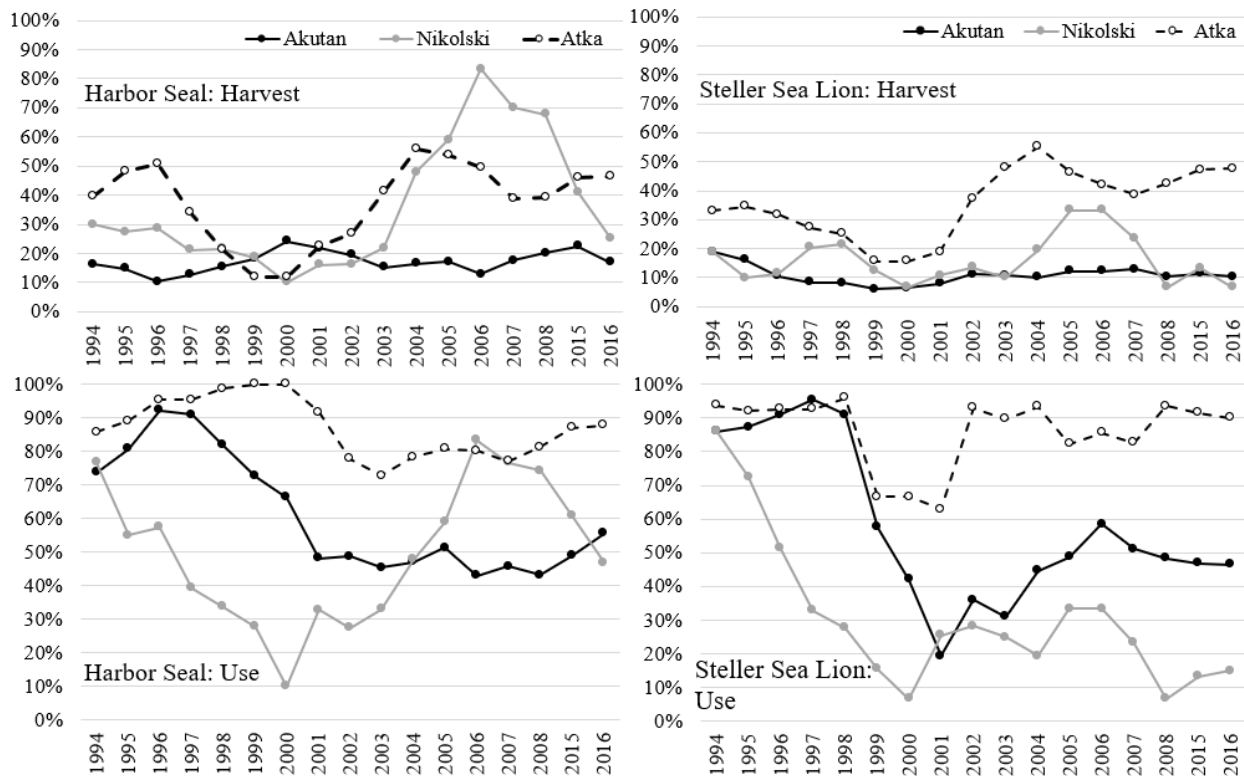


Figure 9. 3-year moving average of the percent of households harvesting and using harbor seals and Steller sea lions. Historic data from Davis 2005 and Wolfe et al. 2009

### *Subsistence Geography: Where Do People Hunt?*

To show where residents of the study communities harvest resources, we used the 2015 harvest data from Akutan and Atka and the 2016 data from Nikolski. The overall area used for subsistence in 2015 was much greater around Atka (1,663 km<sup>2</sup>) than around Akutan (193 km<sup>2</sup>). See Figures 10 and 11. Some Atka residents even reported harvesting subsistence resources in Unalaska, 570 km away. That is much farther than the maximum distance Akutan residents reported traveling in 2015 (29 km).

Only Akutan has earlier spatial subsistence data, and that shows in 2008 the use area—437 km<sup>2</sup>—was much larger than in 2015, when it was 193 km<sup>2</sup> (Figure 10).

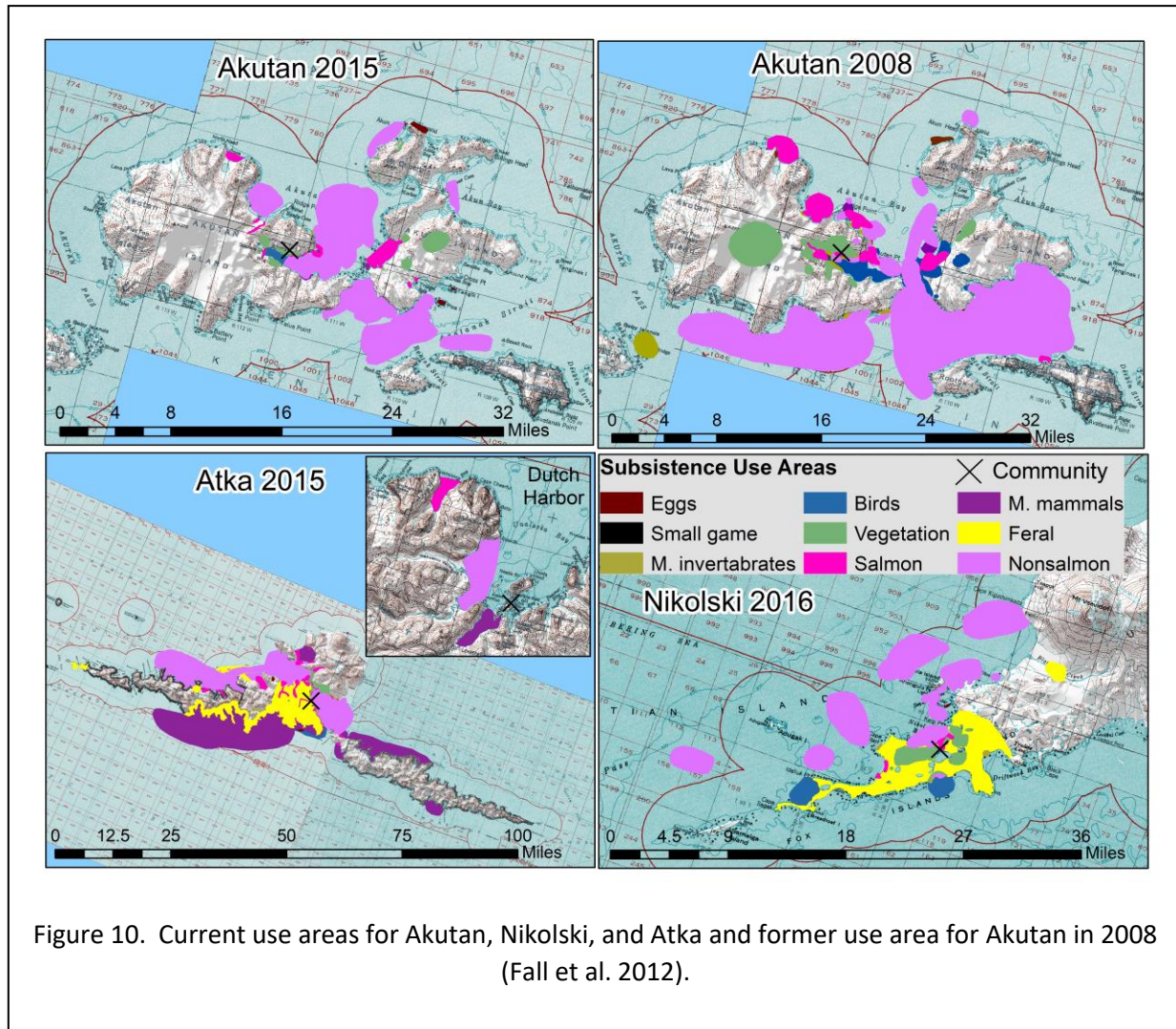


Figure 10. Current use areas for Akutan, Nikolski, and Atka and former use area for Akutan in 2008 (Fall et al. 2012).

Harvesting for fish other than salmon by 18 residents (12 with spatial data) covered the largest subsistence use area (164 km<sup>2</sup>), followed by harvesting vegetation (13 km<sup>2</sup>) and salmon (11 km<sup>2</sup>). The largest use area among Atka residents was for reindeer (960 km<sup>2</sup>), which overlapped with the next two largest resources use areas, marine mammals (886 km<sup>2</sup>) and fish other than salmon (585 km<sup>2</sup>). There are some available data on places where Atka residents harvested salmon before our study, and those data indicate that residents in the past used some of the same places, but also traveled further on Amilia Island to harvest salmon.

Again, Akutan is the only community with comparable data before our study. That data show that the overall area Akutan residents used for subsistence activities declined by nearly 50 percent. That area was 193 km<sup>2</sup>/75 miles<sup>2</sup> in 2015, down from 437 km<sup>2</sup>/139 miles<sup>2</sup> in 2008 (Fall et al. 2012). The use

area for marine mammals was only 9% of the area used in 2008. Even though the number of households that harvested salmon increased, the use area decreased by 50%. Overall households were staying closer to the community in 2015 than in 2008. The drop was especially noticeable for hunting waterfowl. Before World War II, residents of Akutan traveled as much as 70km (43 miles) for waterfowl, but in 2015 less than 5km (3 miles). Prior to WWII likely the availability of feral animals was less and since waterfowl are individually smaller they can be harvested far from the community and transported by skiffs more easily than large marine mammals.

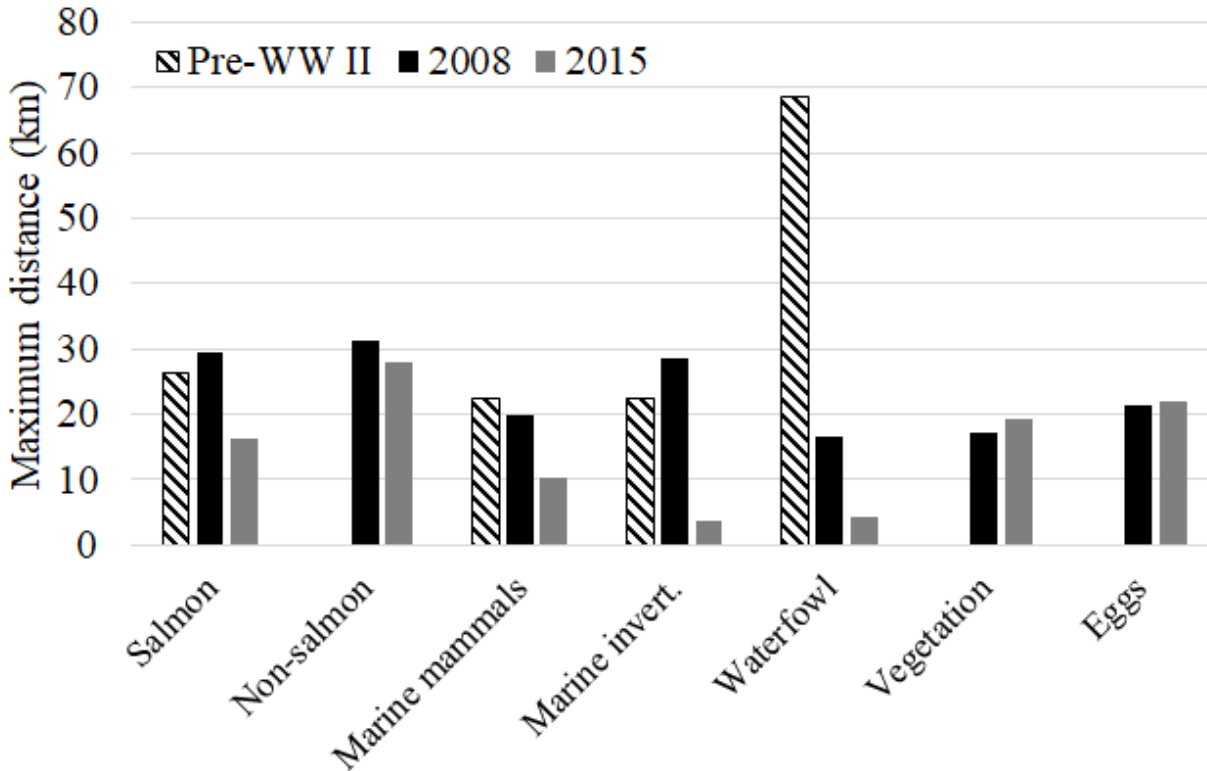


Figure 11. Distances traveled by Akutan residents to harvest subsistence foods pre-WWII (Fall et al. 2012), 2008 (Fall et al. 2012) and 2015.

### Perceived Changes in Subsistence

Overall, people we surveyed in the three study communities reported that enough subsistence resources are available, and in general those resources are healthy. Most residents of Atka report still participating in a wide variety of subsistence activities and continuing to use those resources the way they did in the past.

But people we interviewed in all three communities did say that participation in subsistence can be reduced by jobs, availability of purchased Western food, and technology—like television, video games, and the Internet. Residents of Akutan and Nikolski also reported declines for additional, different reasons.

In Akutan, during a community meeting, participants said that community residents need skiffs to harvest waterfowl and marine mammals—and that is likely is part of the reason harvests have declined. Fall et al. counted eight skiffs in 2008, while we counted only four in 2016. Changes in boat ownership might also be part of the explanation for the decline in travel distances from Akutan. People need larger boats to get out into rough waters. Because such larger boats are used for commercial fishing, when fewer people go out commercial fishing, that can also affect subsistence participation, if it means that fewer large boats are available. Skiffs are probably especially important in Akutan because getting to another beach, away from the community, by foot or even ATV, is very difficult if not impossible. And residents of Akutan also pointed out that “if people can get food closer, why bother to use more fuel to go further?”

And some studies have found that the Trident Seafoods processing facility has harmed the water quality in front of the community (EPA 1995a;b, DEC 2010). Also, since Akutan became a second-class city in 1979, and now captures fish taxes from Trident, some residents believe Akutan has “shifted away from subsistence” because that tax money resulted in a larger community store and more cash in the community.

In Nikolski, declining trends in subsistence harvests are likely linked to the declining population. Some residents said conservation is important, and there is no use in harvesting a large marine mammal if there are not enough community households to ensure all the animal will be used. Also, some mentioned that with fewer children living in the community, there are fewer opportunities to take kids out hunting or gathering as part of outdoor activities.

Some people we interviewed also talked about changes in climate. Residents perceived more changes during winter, with less snow and warmer temperatures. “Puzzling” is how one resident described it. Variation from year to year is also significant from island to island in the Aleutians. For example, in Akutan snowfall was nearly non-existent in the winter of 2015-2016 (Figure 12), while in Atka, a resident said there was, “the best snow we’ve had in a while . . . the past four or five years, we’ve probably never had snow for Christmas.” And even though subsistence foods are plentiful, weather has influenced their abundance. People we talked to commonly mentioned that berries are affected by either too little or too much rain—but there was no agreement on a consistent trend in rainfall. Halibut and Pacific cod are influenced by climate as well, with local people saying they are going deeper with the moving thermocline—but that movements of halibut are also harder to predict. Residents said that both cod and halibut are influenced by non-climate factors like commercial fishing, and that halibut are also influenced by crab abundance.



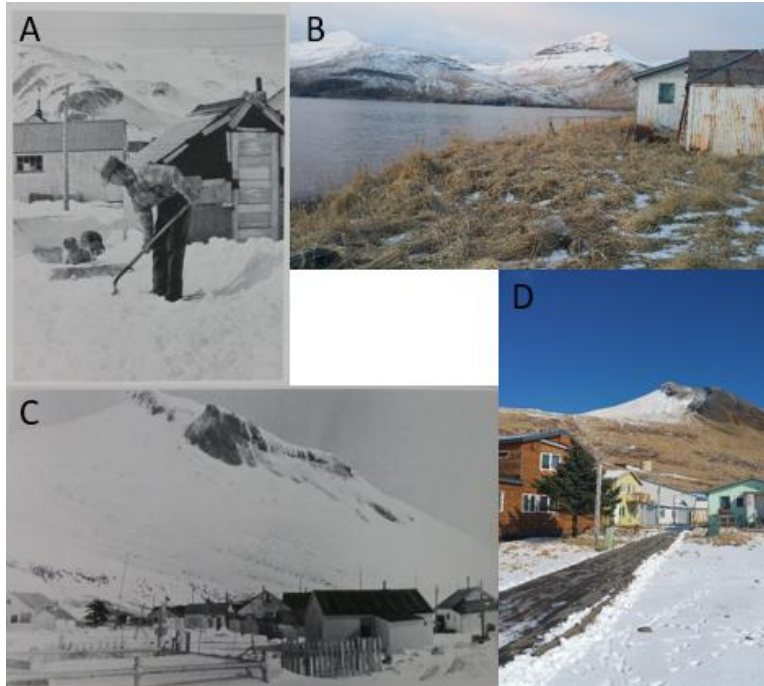


Figure 12. Pictures from Akutan. From upper left to upper right to lower left to lower right. A) A man shoveling snow in Akutan in 1977 B) Akutan in the winter of 2016. C) Winter in 1977 in Akutan. D) Same hill as in C but in March 2015.

## Conclusions

We observed large changes in subsistence participation and harvests in the three Aleutian island communities we visited, based on what local residents told us. They agreed that things are changing, both environmentally and socially. Mostly weather is getting harder to predict; there are now very warm days in the summer and less snow in the winter. Socially, people acknowledge they get things from the store or order from the Internet more often: young people simply prefer different food than the generation before, and economies change. But people still have reasons for preferring to live in rural Alaska, regardless of these changes. The Aleutian Islands are home to many people who find leaving unattractive. They may enjoy the pace of life, the ability to hunt and fish often, or the peace of being away from the city. Still, people are adapting. The main drivers of change today appear to be social rather than environmental—but the two may be coupled to result in larger challenges over time.

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