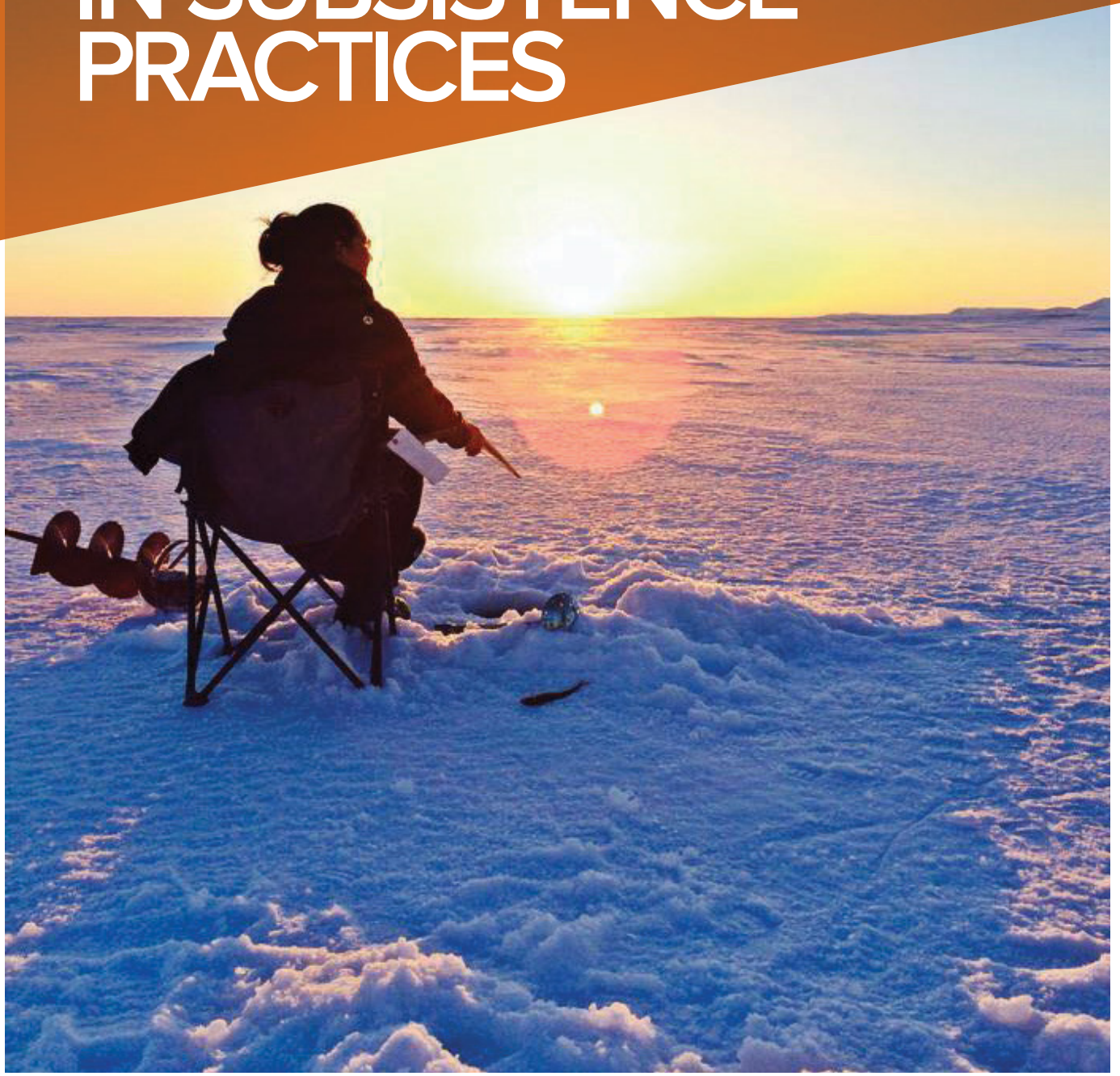
CHAPTER 3: AGE, GENDER, AND VILLAGE VARIATION IN SUBSISTENCE PRACTICES



Evelyn Schaeffer ice fishing near Kotzebue. Photo credit: Marceline Lee.

CHAPTER 3: AGE, GENDER, AND VILLAGE VARIATION IN SUBSISTENCE PRACTICES

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Jaime Lambert cutting blubber off the skin at Ivik. Photo credit: Qutan Lambert.

Areas Searched and Diversity of Species Harvested Across the Study Area

Total Area Searched

In this study, total individual search area includes the sum of all of the places a participant told researchers she or he normally goes. Each study participant would point to a map location in response to a researcher's question, e.g., "Where do you search for caribou in the fall?" We then totaled the union of all of the areas where the person hunts, fishes, and gathers.

When a person reported revisiting the same place during different seasons or if he or she went back to that place to look for a different kind of food, the place was still counted only one time for inclusion in that person's total individual search area calculation.

The smallest total area a study participant from any of the seven villages reported searching was approximately 11.5 square miles (30 km^2). On the other end of the spectrum, the person who reported the largest search area has covered over 16,000 square miles (41,440 km^2). The median area searched was 1,965 square miles (5,089 km^2). The middle 50% of people participating in the study have searched between 323 and 2,320 square miles (between 836.5 and 6,009 km^2). See Figs. 3.1-3.4 on the next page.

Unique Search Areas and Species

The number of unique areas searched by an individual ranged from 3 to 141, with a median of 23. The middle 50% of interviewees identified 18 – 38 unique search areas. The number of species individuals harvested ranged from 6 to 92, with a median of 33. The middle 50% of study participants reported harvesting 24 – 43 different species.

Crew working together to pull beluga on the ice. Photo credit: Wendie Schaeffer.

FIGURE 3.1–3.4

FIGURE 3.1 Total search area is the area of the union of all polygons for a given individual. Tick marks below the histogram indicate the precise location of each data point ($n = 160$).

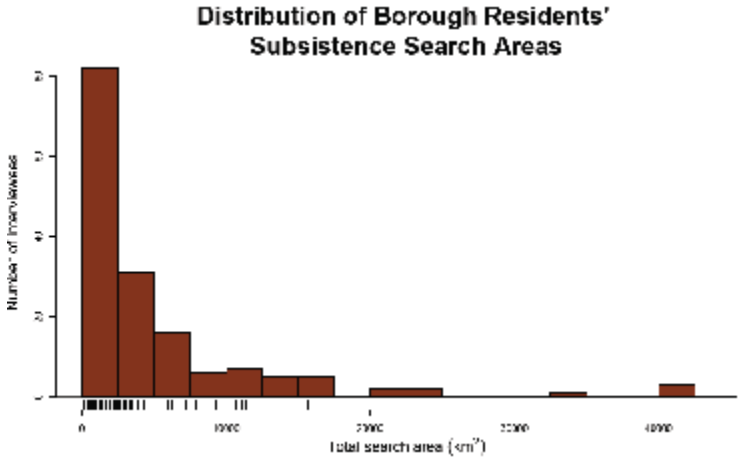


FIGURE 3.2 The graph displays the same data as Fig. 3.1 after applying a mathematical transformation to normalize the data for statistical purposes. This distribution was normalized with the optimal exponent transformation (i.e., that exponent for which normality was greatest—quantified by the largest p-value using the Shapiro-Wilk test). The optimal transformation was found to be $x' = x^{0.1}$, (Shapiro-Wilk test: $p = 0.65$), where x represents the raw data, and x' the transformed data.[a]

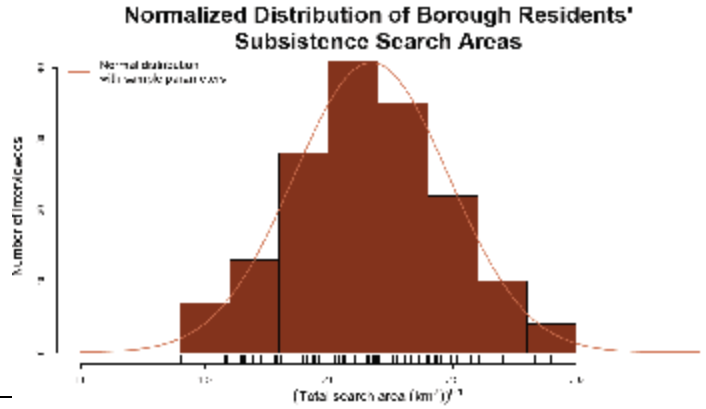


FIGURE 3.3 Individual data points are indicated as tick marks below the histogram, with slight random jitter introduced to minimize over-plotting.

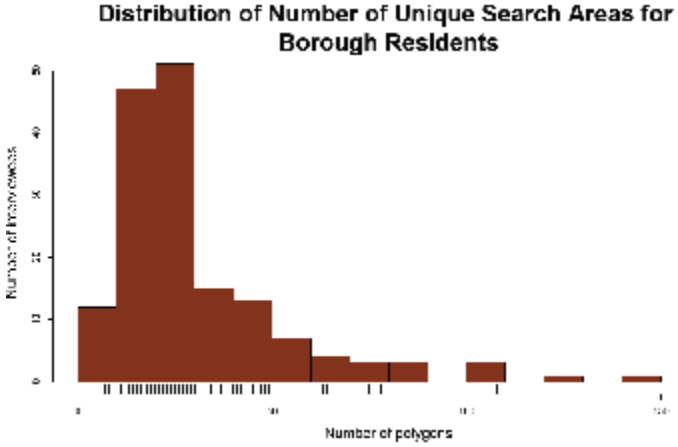
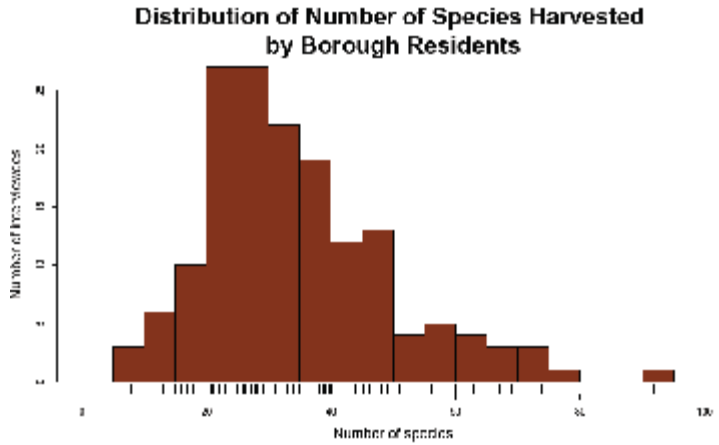


FIGURE 3.4 Individual data points are indicated as tick marks below the histogram, with slight random jitter introduced to minimize over-plotting.



[a] The other two metrics, number of unique search areas and number of species, show similar long-tailed, right-skewed distributions (*see* Figs. 3.2 and 3.4). These were also normalized using optimal exponent transformations: the exponents were -0.04 for unique search areas (Shapiro-Wilk test: $p = 0.15$), and 0.31 for number of species (Shapiro-Wilk test: $p = 0.77$).

Age, Gender, and Village Variations

As explained in the Introduction to the atlas, the main reason people were interviewed for this project was to determine and document, in words and on maps, where people who live in the western-most parts of the Borough conduct their traditional hunting, fishing, and gathering activities today. We also documented study participants' traditional knowledge of locations, abundance, and behaviors of the species they depend on for subsistence (*see* ch. 2, part 2) and, for coastal and marine species, considered other studies' findings next to that local and traditional knowledge (*see* ch. 4).

In addition to successfully mapping villagers' subsistence areas and recording and mapping local and traditional knowledge, while working with study results, the project's head researcher, Dr. Satterthwaite-Phillips, discovered some interesting variations in subsistence activities that appeared to be related to certain demographic factors. Using statistical methods, he prepared the following analyses to explore the variation in subsistence practices with respect to the gender, age, and place of residence of the different participants.

Gender Variation

In traditional Iñupiaq society, hunting and trapping have primarily been male endeavors, and plant and berry gathering and much of the preserving and preparing of food have been done by women. Fishing is generally thought to be the dominion of both men and women, though interviews brought to light some regional and interpersonal variation when it comes to whether fishing is "men's work" or "women's work."

These divisions of labor are, in large part, confirmed by the following analyses, although in the course of the interviews, there was mention of at least a few female elders (typically, women without brothers) who hunt and trap, and among younger adults, although female hunters are still few, there seem to be a few more now than in the past. In this chapter, we look at various aspects of subsistence by gender and age. We found that men travel over more areas and visit more unique search areas than women, but the subsistence "gender gap" closes quite a bit when it comes to the number of unique species gathered.

No one interviewed in this study assigned greater value to the efforts of fishermen like Edith Pungalik's sons than to her processing of the fish the boys bring home (*see* pp. 72-73). Whether done by men or women, children, middle-aged adults, or elders, all contributions appear to be valued. Just as meat is shared among villagers, so is appreciation for finding, bringing back, preserving, and serving up traditional Iñupiaq food.

> **"My most memorable subsistence experience was the trip I caught my first caribou. For years, I followed hunters just to help cut. That one hunting trip, my father let me shoot, and I caught my first caribou. The look of pure proudness on my father's face will always make that my favorite hunting trip. That feeling of accomplishment and putting food in your freezer."**
>
> ***Josephine Howarth, Kotzebue***

Age Variation

A person's age appears to affect subsistence practices, as people go out less frequently past a certain age. Still, elders carry much of the knowledge about where to go, when to go, and what to watch for. While elders in the region well remember the days of traveling by dog sled and *umiaq*, younger people may have trouble imagining what it was like to get around without four-wheelers, snow machines, and motorboats. But modern dependence on the internal combustion engine has turned out to be somewhat of a mixed blessing for the Borough's residents. Several people we talked to mentioned lack of cash to buy gas or do upkeep on a vehicle as a reason they haven't been getting out as much as they would like. The sled and *umiaq* may have been slower and less efficient, but people didn't need to have money coming in to operate them. Today, villagers learn at a young age how to operate and repair vehicles. While it may be the elder who knows the good places to go and directs others to a successful hunt, physical limitations related to aging do reduce elders' harvesting activities and increase their reliance on others' sharing.

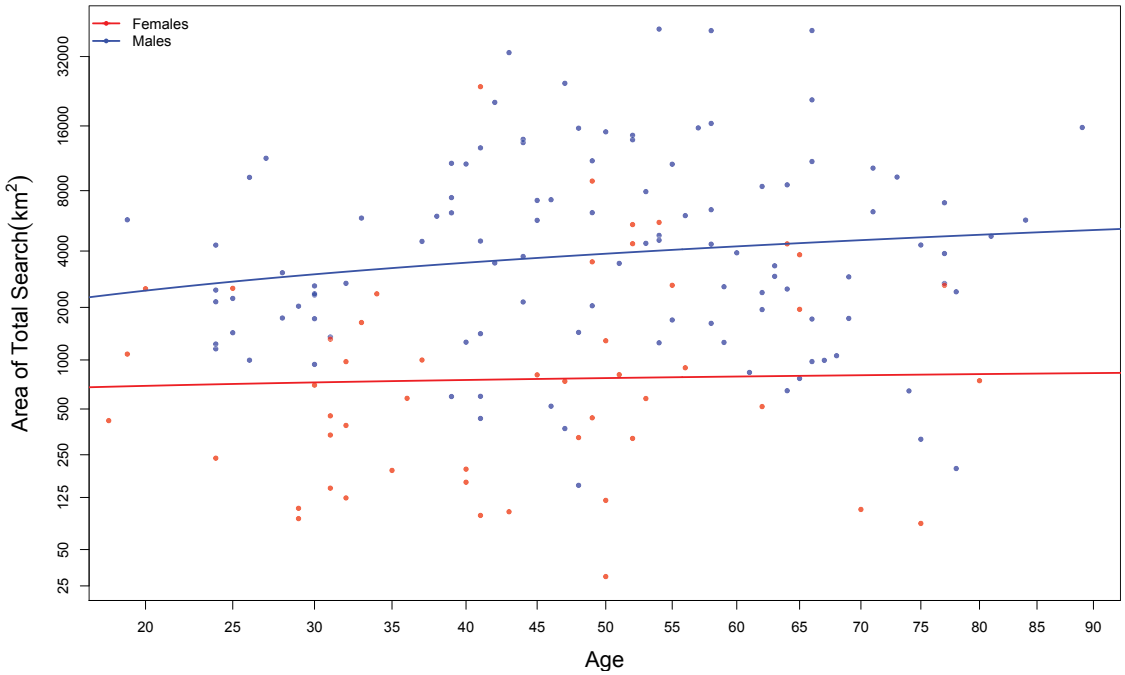
In general, it can be assumed that as individuals age their familiarity with the land and the plants and animals that live on it will increase, so we might expect all three of our metrics to increase as age increases—i.e., over their lifetimes, older individuals will have covered more total area, been to more unique locations, and harvested a greater number of different species than someone younger.

Using total area as an example, we modeled the area covered as a function of age, adding gender and gender-age interactions as covariates to correct for known variability in interviewees' gender composition. Additionally, we investigated non-linear age terms (ln(age), age^2), which

Woman ice fishing in the early 1900s.
Photo credit: UAF-1969-95-72, University of Alaska Fairbanks, Alaska Digital Archives.

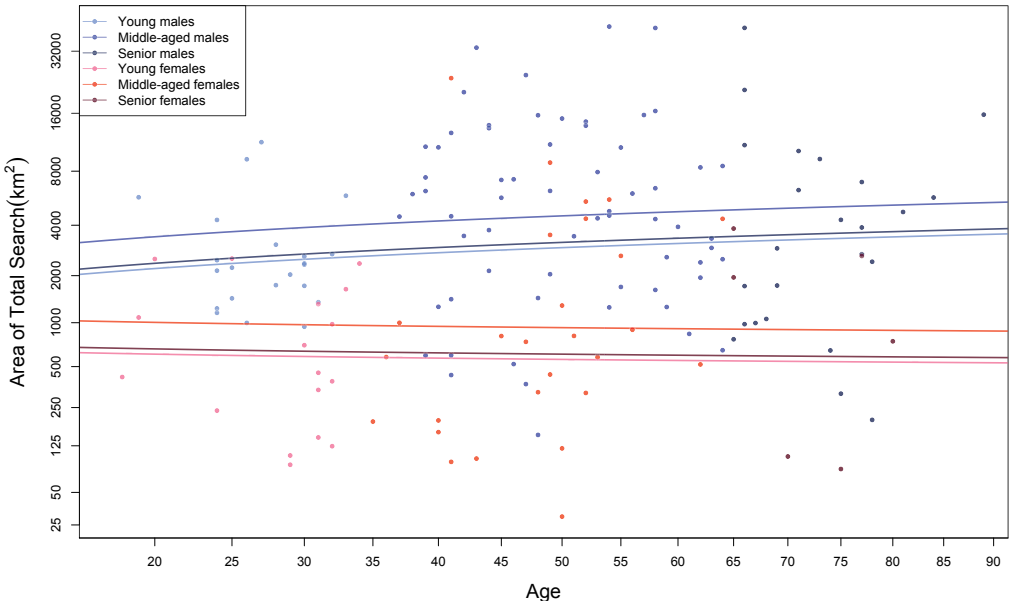
Myrna Mendenhall ice fishing in 2014.
Photo credit: Iva Smith.

FIGURE 3.5 TOTAL SEARCH AREA AS A FUNCTION OF AGE AND GENDER.



Individual female data points are shown in red, and males in blue. Note that the axes are scaled according to the transformations—spacing between tick marks on the y-axis represents an approximate doubling in area.

FIGURE 3.6 TOTAL SEARCH AREA AS A FUNCTION OF AGE AND GENDER; SUBDIVIDED BY MAJOR AGE CATEGORIES



As in Fig. 3.5, note that the axes are scaled according to the transformations—spacing between tick marks on the y-axis represents an approximate doubling in area.

allowed for the possibility that search area may not increase steadily with age. For instance, people may explore a lot, and cover a lot of ground when they are younger, with area rapidly increasing with age, and then slow down as they get older and have learned to identify better areas with greater success. The model that best fit the data (Fig. 3.5; linear regression, $p << 0.001$, adjusted $r^2 = 0.26$)[1] indicates that there is indeed a tapering off that occurs with age, though it is slight. In general, this model suggests that men steadily increase their search area over a lifetime. In contrast, women tend to have a fairly constant search area over a lifetime. Note, though, that this is not a longitudinal study, and age-based variation should be interpreted with caution as the data come from different cohorts.

To further investigate the generational effect, and how generational changes in modes of transportation, gas prices, and so on may have affected subsistence practices between generations, we added an age range variable to the model, with values young adult for individuals age 18-34, middle-aged adult (35-64), and senior (elder) (65 and above), and refitted the model (*see* Fig. 3.6).

The addition of the age range variable led to a slightly better model ($p << 0.001$, adjusted $r^2 = 0.28$)[2]. There are important observations for both men and women. Specifically, middle-aged adults—both male and female—cover more area on average than young adults or elders, and young adults cover the least area of all. Remember that this model corrects for continuous age variation, so it predicts that even when today's young adults are elders, they will have covered less total area, on average, than either today's elders or their middle-aged offspring.

It is important to examine the extreme values as well as the averages. Harvest surveys conducted by ADF&G have repeatedly demonstrated that about 70% of all traditional food found in a given village has been harvested by only about 30% of the population. This has led to a new term: "super-harvesters." Our findings agree with the state's (e.g., ADF&G 2014 *inter alia*). As seen in the histograms in Figs. 3.14, and 3.15 on pp. 407-408, only a very few people are "super-harvesters," covering much more area,

i

We did not find significant evidence that the food-gathering activities of the top 30% of harvesters among today's young adults will differ significantly from today's middle-aged or elder adults over a lifetime, even though, according to the model, average subsistence practices are predicted to decrease slightly.

and (according to the ADF&G data) obtaining much greater quantities of food. We wanted to examine this dynamic with respect to age and gender—specifically, do the data support the hypothesis that there will continue to be super-harvesters in the future, as today's population ages? It stands to reason that if communities were to stop producing super-harvesters, borough residents would lose much of the food security they enjoy today.

To explore this question, we first sought to estimate how much of a search area an individual will cover over the total extent of his or her lifetime. In order to compare people of different ages directly, we projected the expected lifetime search area at the age of 89 (the age of our oldest participant), using the statistical model described on p. 397-399 (*see* Fig. 3.6[3]). In addition, the model allowed us to preserve the differences in how much above or below average each individual's search area should be.[4]

We did not find significant evidence that the food-gathering activities of the top 30% of harvesters among today's young adults will differ significantly from today's middle-aged or senior adults over a lifetime. Even though, according to the model, *average* subsistence practices for young adults are predicted to decrease slightly (Fig. 3.6), the *top* harvesters among young adults are expected to have lifetime subsistence behaviors similar to the older generations. Overall, then, the results are mixed. On the one hand, the continuing existence of super-harvesters is encouraging and suggests that communities will continue to have traditional foods for the foreseeable future. On the other hand, the decrease in subsistence harvesting by the average young adult may reflect some erosion among young people of the traditional Iñupiaq way of life.

When it came to our other two categories—number of unique areas searched and unique species harvested we arrived at similar results. Gender was the biggest factor in how much total area was covered, how many unique areas were used, and how many species were harvested, though the second and third categories showed less of a difference than the first.[5] (*See* Figs. 3.17, 3.18, and 3.19 on p. 409-410.)

Fig. 3.8 shows number of unique search areas by age and gender, with men frequenting just more than double the number of areas women go out to, on average. It is perhaps surprising that age did not have a significant effect on the number of search areas. One possible explanation is that, rather than searching in completely novel areas, individuals simply expand the borders of existing search areas, while keeping the total number of locations roughly constant. This is supported by the finding that area does increase with age, as mentioned earlier.

Finally, looking at the variation in the number of unique species (Fig. 3.9), site, age range, gender-site, and gender-age range interactions were all found to be significant predictors.[6] An interesting finding is that, on average, younger males harvested a wider variety of species than older males. In females, middle-aged women harvested a wider variety of species than young adults or elders, though in neither males nor females were these findings significant.[7] Overall, however, males of every age range harvested more species on average than females of every age range.[8]

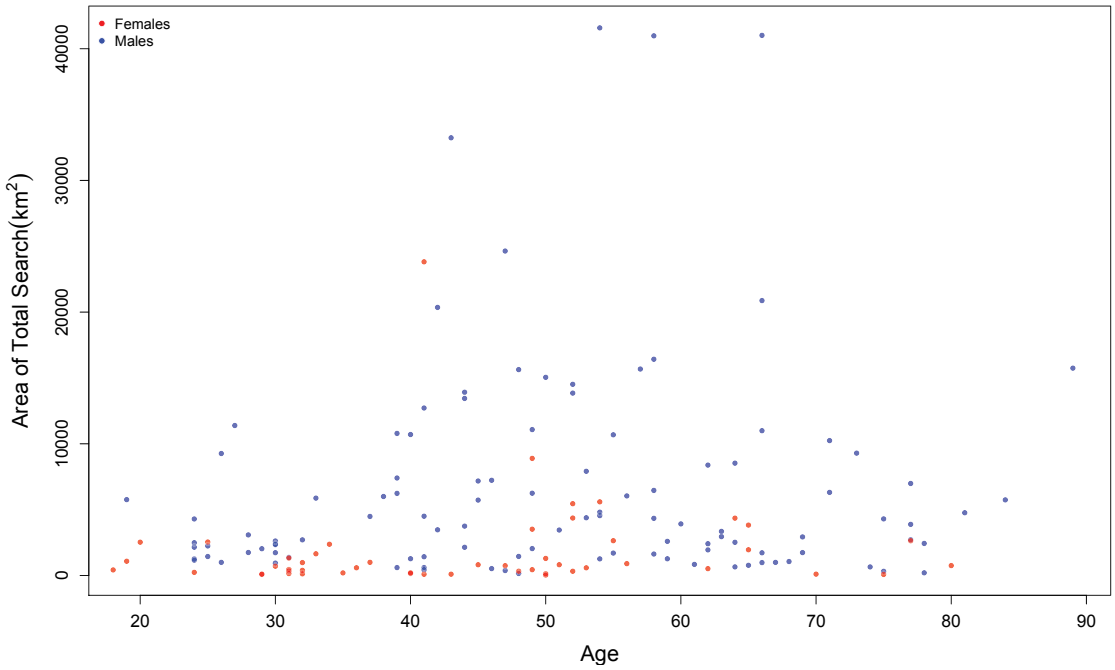
Additional figures showing variation in subsistence activity by gender and age can be found at the end of this chapter.

Three generations of Kotzebue sheefishers. Photo credit: Karmen Manigold.

Variation by Age: Examining the Variance

While the linear models are good at indicating *average* trends, they are less useful for examining the variation that exists within groups. Replotting Fig. 3.5 as Fig. 3.7, but rescaling the *y*-axis to be arithmetic rather than logarithmic units, this variation is more readily apparent.

FIGURE 3.7 TOTAL SEARCH AREA AS A FUNCTION OF AGE: LINEAR AXES.



These data are the same as those presented in Fig. 3.5 and Fig. 3.6 above, but, here, the axes are continuous—spacing between tick marks on the y-axis are constant (1000 km^2) instead of doubling as in the above images. This representation makes the variation that exists in individuals' search areas more readily apparent.

FIGURE 3.8 NUMBER OF UNIQUE AREAS SEARCHED, AS A FUNCTION OF AGE AND GENDER.

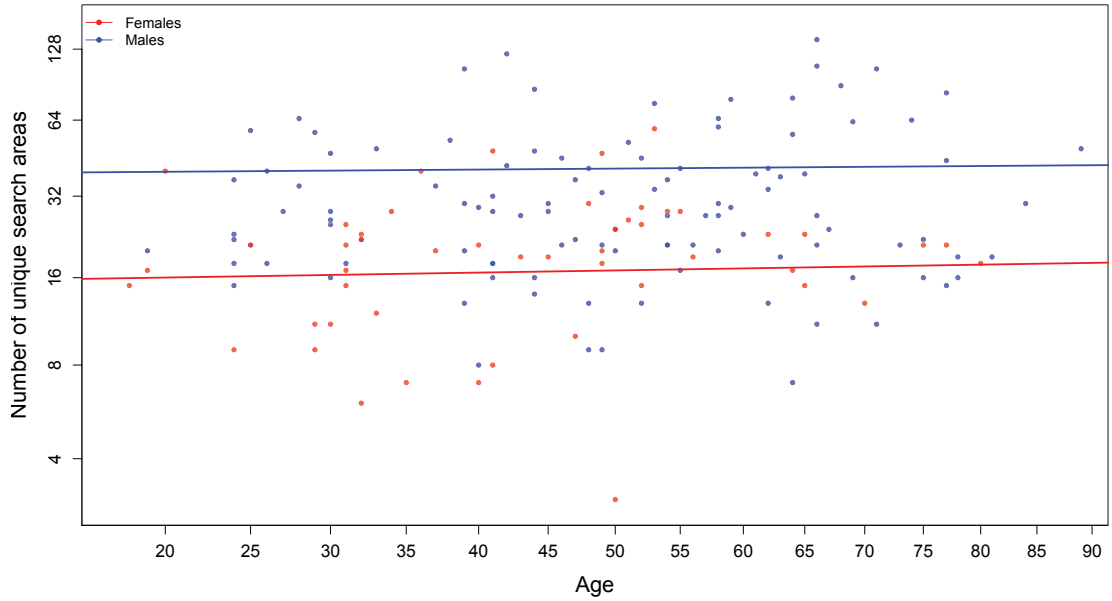
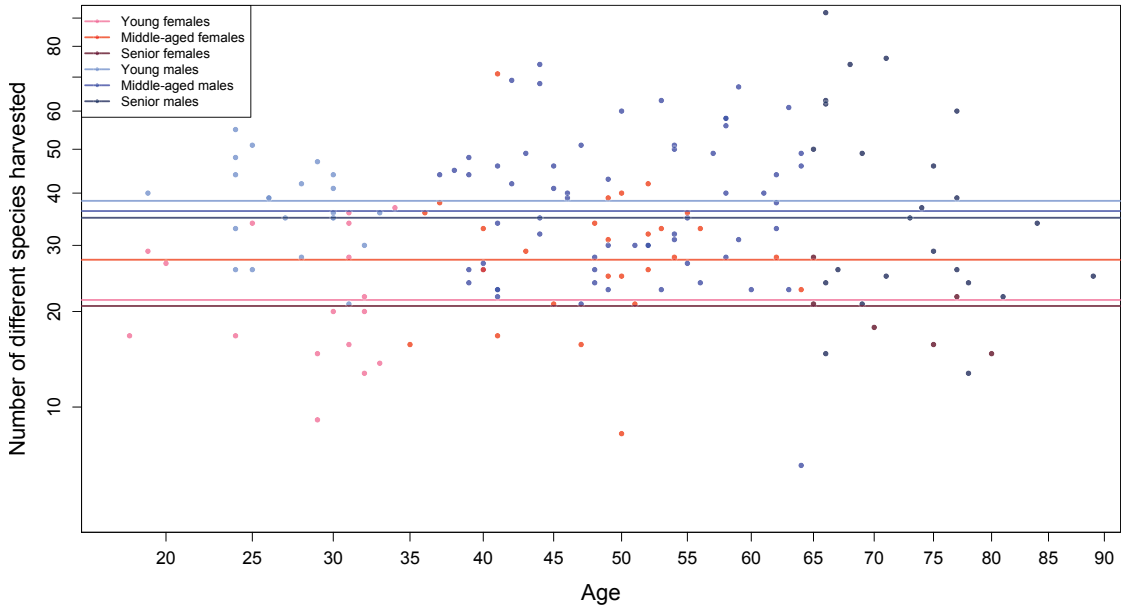


FIGURE 3.9 NUMBER OF UNIQUE SPECIES HARVESTED AS A FUNCTION OF AGE AND GENDER.



As with some of the previous scatterplots, note the scaling of the axes in both figures on this page; spaces between tick marks on the y-axis represent a doubling in value.

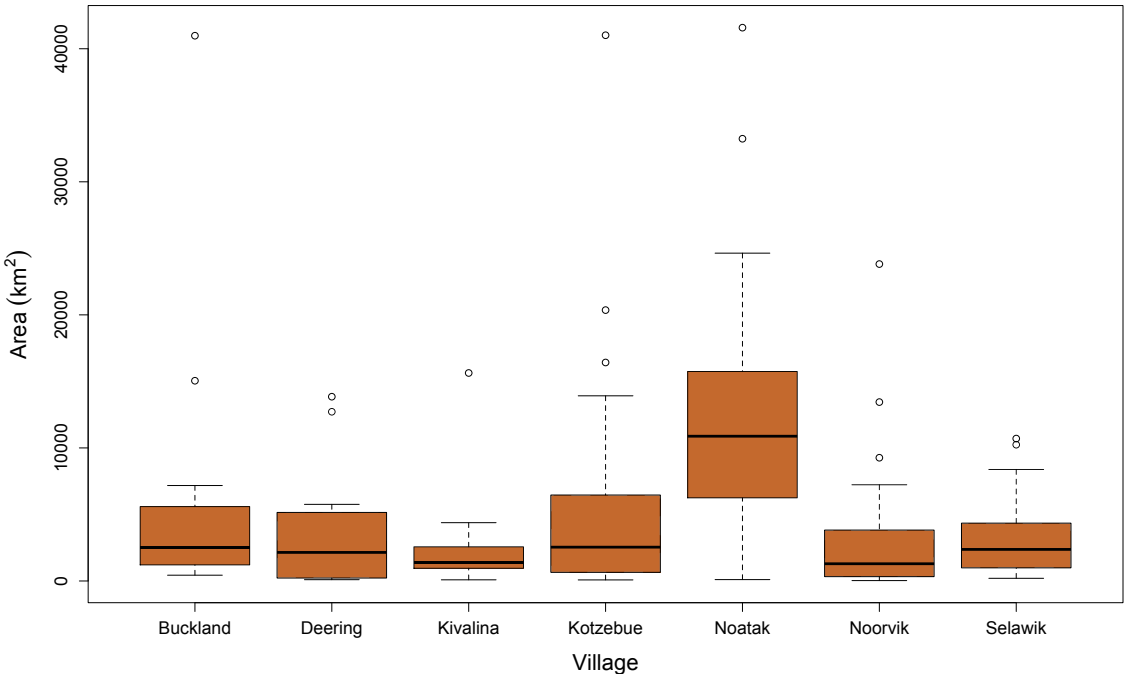
Village Variation

We found some interesting variation in the amount of area that individuals from different villages cover to find subsistence resources, as shown in Figures 3.10 – 3.12. Further study is needed to locate and determine how economic, ecological, and other variables affect village-based differences in hunting, fishing, and gathering. A number of factors could be in play, ranging from socioeconomic conditions to travel conditions across the local terrain to species diversity in the area surrounding a village, or myriad other possibilities. It may be that some communities are more specialized in hunting certain species and are able to successfully focus their efforts on those species. For example, whaling communities are able to produce a considerable amount of food from a single successful hunt. We therefore caution the reader in interpreting these figures, as differences may be attributable to one or more of the other variables that we did not explore, rather than to intrinsic differences among the villages themselves.

i

For all boxplots, the box itself indicates the interquartile range (IQR), or middle 50% of the data, with the dark horizontal bar representing the median value. The "whiskers," or lines extending beyond the boxes, extend to the furthest point not greater than 1.5 times beyond the IQR. Points lying at greater distances are sometimes called "outliers" and plotted as individual points.

FIGURE 3.10 VILLAGE-BASED VARIATION IN TOTAL SEARCH AREAS.



For all boxplots, the box itself indicates the interquartile range (IQR), or middle 50% of the data, with the dark horizontal bar representing the median value. The "whiskers," or lines extending beyond the boxes, extend to the furthest point not greater than 1.5 times beyond the IQR. Points lying at greater distances are sometimes called "outliers" and plotted as individual points.

FIGURE 3.11 VILLAGE-BASED VARIATION IN NUMBER OF UNIQUE SEARCH AREAS.

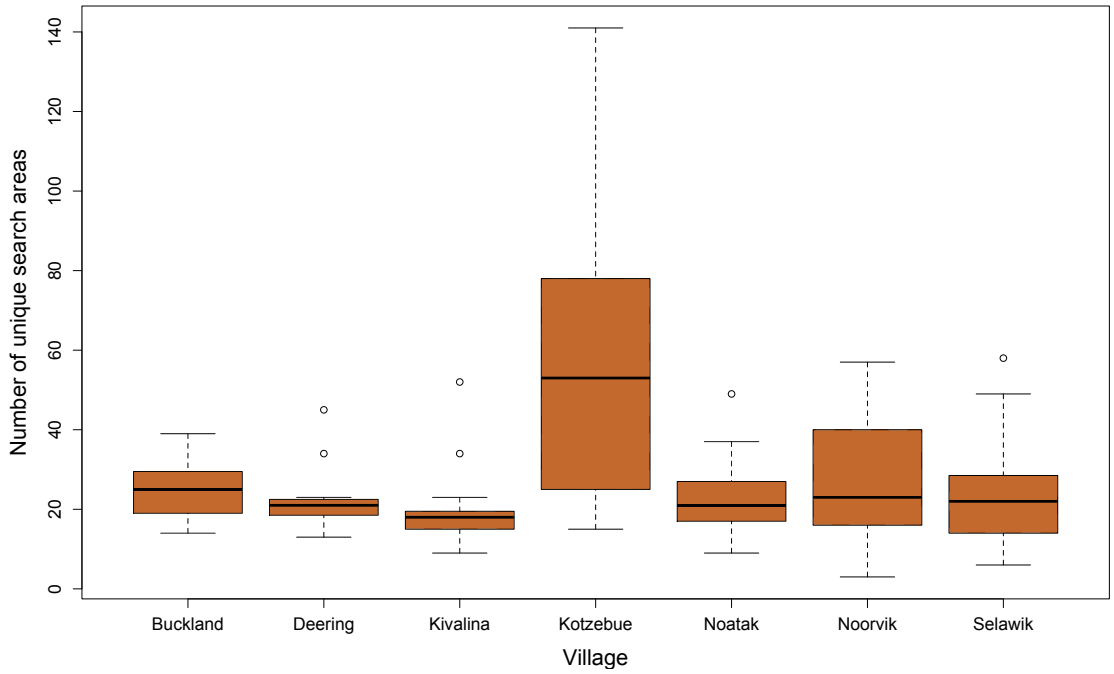
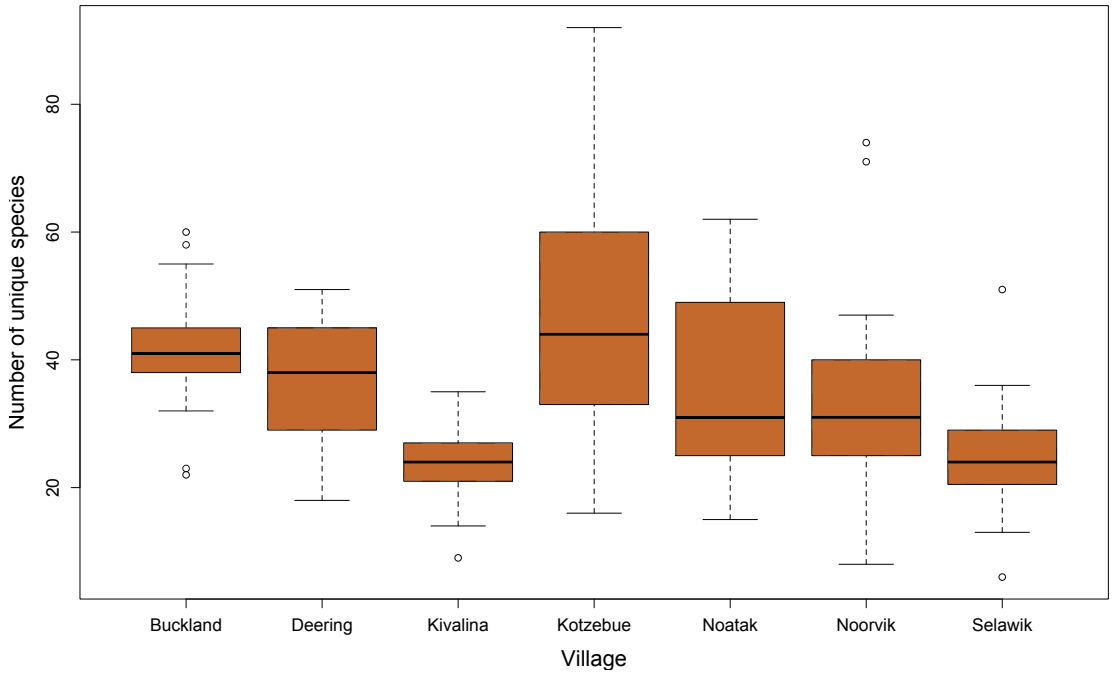


FIGURE 3.12 VILLAGE-BASED VARIATION IN NUMBER OF UNIQUE SPECIES HARVESTED.



Sierra Schaeffer working on beluga *maktak* at her family's camp at Sadie Creek. Photo credit: Wendie Schaeffer.

Interpreting the Results on Gender, Age, and Village Variation

Under each of the three categories, a similar pattern seems to emerge. Middle-aged adults appear to have been more active than either young adults or elders when they were active. In fact, when it comes to subsistence-related behaviors, young adults today appear to have a lot in common with elders. However, these findings conflict with the popular opinions that many interviewees voiced: young people are much less active than any of the prior generations—less familiar with the land and less knowledgeable about how and where to find resources. Similarly, young people themselves lament the fact that, with parents working, there is no one to teach them how and where to find or prepare food. We therefore warn the reader against over-interpreting these findings as well, as they may miss some other important variables, such as time and success rates.

Time and Success Rates— With the introduction of snow machines, motorboats, and four-wheelers to the region, it has become commonplace for the Borough's residents to make day trips. An individual can search for and gather the needed subsistence resources more quickly and efficiently, as a lot of ground can be covered in a relatively short amount of time. Even if a search is not successful, the individual can return home and try again another day with relative ease. The elders who participated in this study still remember well the days of getting around by *uniat* (dogsled), by paddling a *qayaq* (kayak), or a larger *umiaq* (larger multi-person skin boat), or even walking great distances. In those days, day trips typically weren't a possibility. People would go out to their camps, or elsewhere if necessary, and stay out until they managed to gather all the resources they needed, even if it meant staying out for a week or more. As a result, even though it appears on paper that young people travel as far as their elders did, the amount of time they spend out is likely a fraction of the time elders remained out on the hunting, fishing, and gathering grounds of their youth. And, whereas coming home empty handed today remains undesirable, in earlier days it often simply wasn't an option. So, hunting trips were likely to have had higher rates of success in the past, even if at the expense of having to spend greater amounts of time to achieve that success.

Costs of Fuel and Gear— Another consideration, when comparing young and middle-aged adults in particular, is the cost of fuel and gear. Even with a dip in fuel prices in the last year, the cost of flying in equipment like nets, agars, ammunition, spare parts for vehicles, and the like is still steep—far above what it was 20 years ago. Therefore, adults today subsist under greater financial constraints than their parents did.

Memory— One final consideration when interpreting the above results involves limitations on human memory. The more years that pass, and different hunting, fishing, and gathering excursions accumulate, the easier it is to forget some of them, particularly in the context of a single interview. Young people, who have been out only a handful of times, all within the past few years, are likely to have better recall of all the details than elders who have been out thousands of times over a span of a lifetime. In particular, elders are more likely to recall areas that led to successful food-gathering, forgetting those areas that didn't turn up

Augie Nelson's great grandaughter Evangeline Ferguson watches him gut a fish.
Photo credit: Elizabeth Niiqsik Ferguson.

anything. This would naturally result in an under-reporting of search areas among the elder interviewees, and a more filled-out account by young people in our sample. As one study participant lamented when asked to recount years of activities, if you asked a New Yorker to list all the places he or she had ever gone to buy food over a lifetime and which foods he or she had purchased where, the person would have a difficult time recounting the past month, much less a lifetime.

Finally, we must bear in mind the potential effects technology could have in making subsistence hunting more efficient in the future. Cell phones and social media networks, such as Facebook, have already led to increased communication among borough residents, allowing individuals to share information about caribou or seal migrations, for example. While it may be impossible to predict all of the things technology will continue to bring to village life, and subsistence practices in particular, it is only reasonable to assume new, more efficient ways of searching for, harvesting, and storing traditional foods, and less costly ways of traveling to search areas, will be available to upcoming generations.

FIGURE 3.13 PREDICTED SEARCH AREAS OVER A LIFETIME FOR CURRENT YOUNG ADULTS, MIDDLE-AGED ADULTS, AND ELDERS.

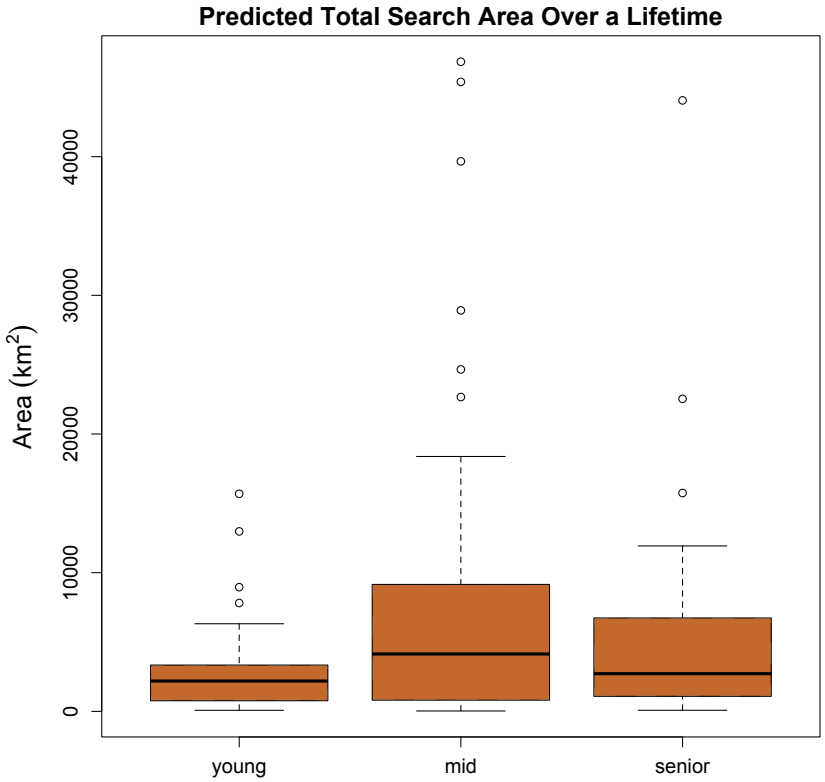
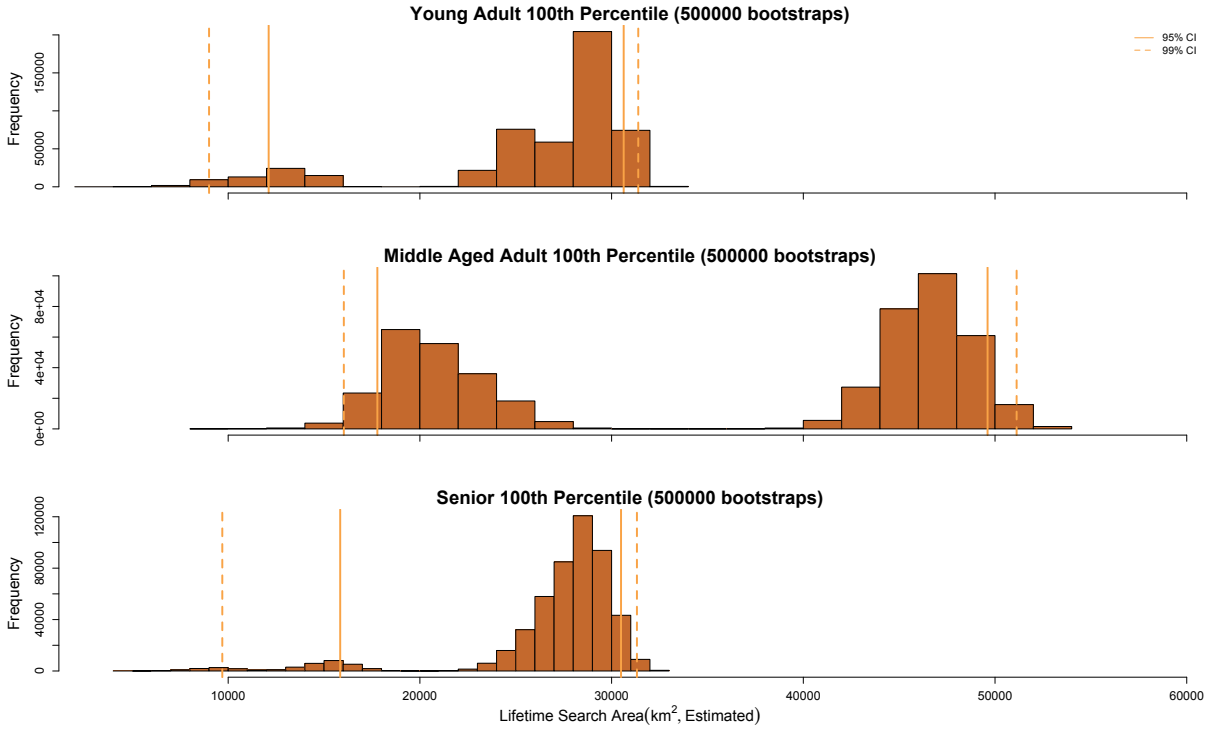


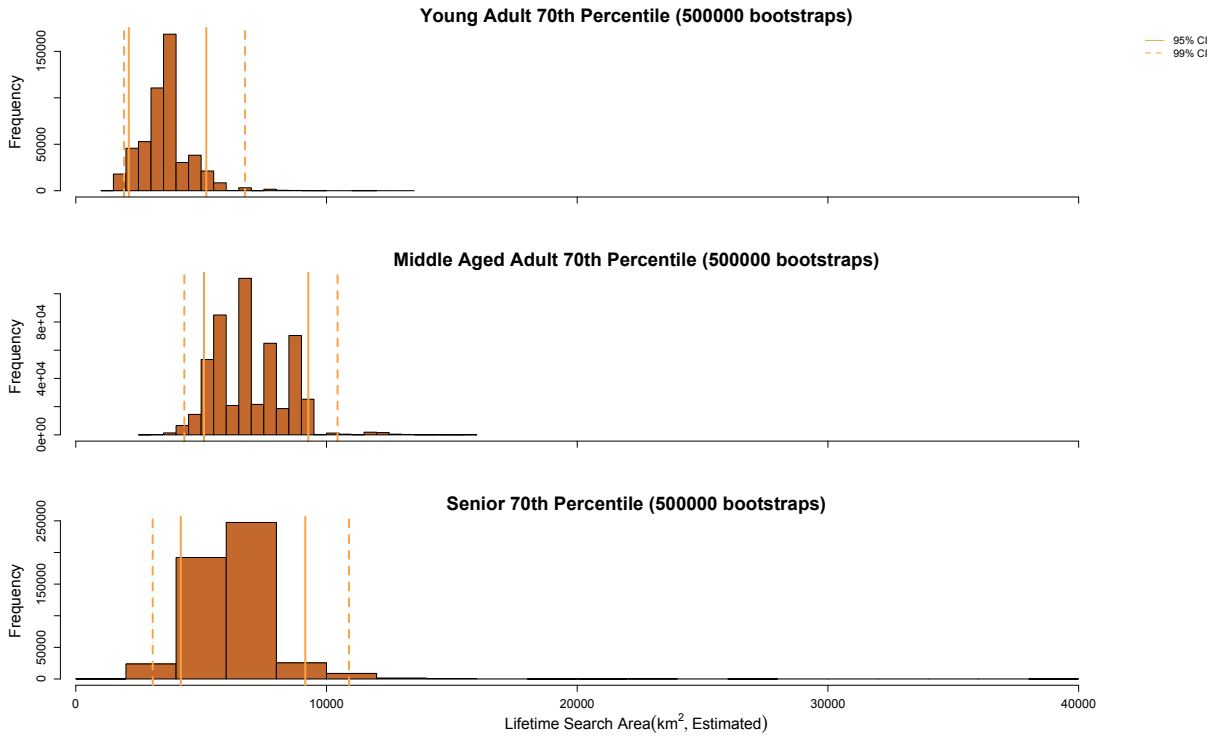
Figure 3.13 shows the anticipated *lifetime* search areas for people who are *currently* young adults, middle-aged adults, and seniors. While the graphic suggests that young adults are indeed expected to cover less area, we calculated the probabilities that different quantiles differ using bootstrapped estimates. This was achieved by repeated random resamplings (with replacement) from the predicted lifetime values with sample sizes matching our actual sample (young adults: $n = 39$; middle-aged adults: $n = 91$; seniors: $n = 30$). From 50,000 such resamplings we calculated the quantiles. Figs. 3.14 and 3.15 show the results for 100th percentile (maximum) and 70th percentile estimates respectively. These estimates suggest that there are not significant differences in the expected maximum values. Similarly, we computed these estimates for all deciles above the 50th percentile and there were no significant differences in area (at the 95% confidence level) for the upper 30% of each age range. In other words, these data do not indicate that the top 30% of harvesters among today's young adults will differ significantly from today's middle-aged or senior adults over a lifetime. There is not significant evidence to support the hypothesis that the top harvesters among today's young adults will subsist less (as measured by area covered) than today's middle-aged adults or today's seniors, even though average subsistence practices are predicted to decrease slightly.

FIGURE 3.14 PREDICTED PROBABILITY DISTRIBUTION OF THE TOP HARVESTER'S TOTAL SEARCH AREA OVER A LIFETIME AMONG TODAY'S YOUNG ADULTS, MIDDLE-AGED ADULTS, AND SENIORS (ESTIMATES OF MAXIMUM VALUES)



This graphic indicates that, over a lifetime, the largest search area of any of today's young adults will be between approximately 9,000 and 31,500 sq. km (3,500 and 12,000 sq. mi. 99% confidence interval—top row, range between dotted lines), and 12,000 and 30,500 sq. km (4,600 and 11,700 sq. mi. 95% confidence interval—solid lines). Similarly, among today's middle-aged adults, the maximum search area over a lifetime is estimated to be between approximately 18,000 and 49,500 sq. km (7,000 and 19,000 sq. mi. 95% CI), and for seniors, the range is approximately 16,000 - 30,500 sq. km (6200 - 11,800 sq. mi. 95% CI). Because all of these intervals overlap with each other, they are said not to be significantly different (at $\alpha = 0.05$).

FIGURE 3.15 PREDICTED PROBABILITY DISTRIBUTION OF THE TOP HARVESTER'S TOTAL SEARCH AREA OVER A LIFETIME AMONG TODAY'S YOUNG ADULTS, MIDDLE-AGED ADULTS, AND SENIORS (ESTIMATES OF 70TH PERCENTILE VALUES)



This graphic is interpreted in the same way as the previous, except that, rather than predicting the top value for each age range, here, we predict the 70th percentile. In other words, the top 30% of all search areas are predicted to be at least as big as the values indicated in this graphic: for today's young adults, between approximately 200 and 675 sq. km (75 and 260 sq. mi. 99% CI); for middle-aged adults, approximately 450 - 1050 sq. km (175 - 400 sq. mi. 99% CI); and for today's seniors, approximately 300 - 1100 sq. km (115 - 425 sq. mi. 99%CI). Note that, in this case, the 95% confidence intervals come very close to overlapping, and hence are very nearly significant (at $\alpha = 0.05$).

Supplemental Figures for Gender and Age Variation

FIGURE 3.16 VARIATION IN SUBSISTENCE ACTIVITY BY GENDER.

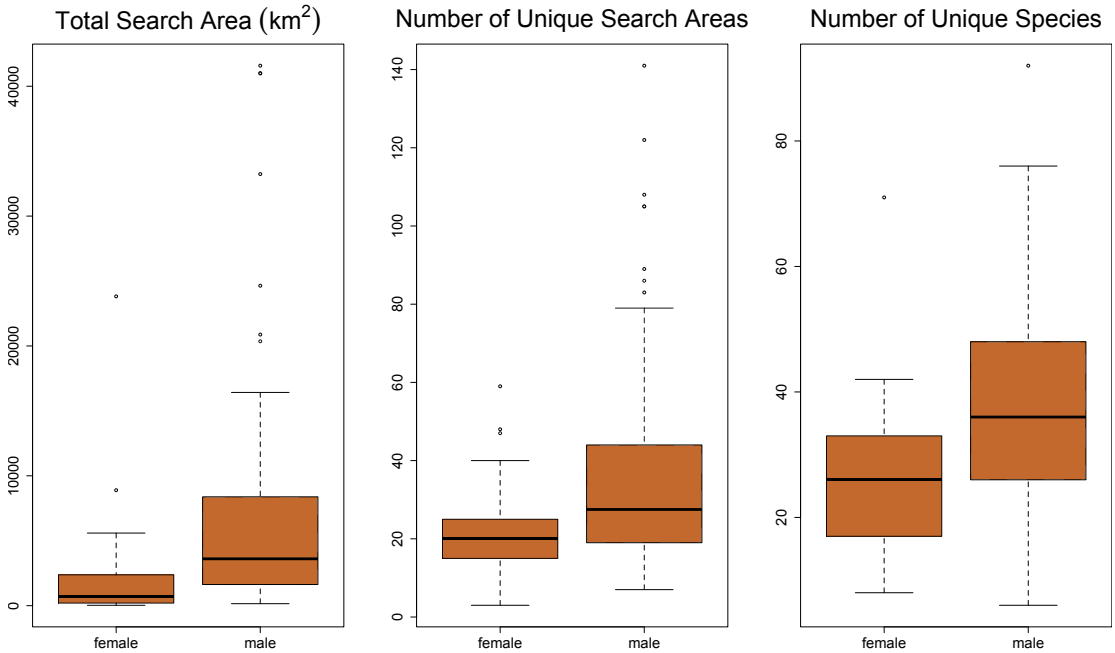


FIGURE 3.17 VARIATION IN SUBSISTENCE ACTIVITY BY GENDER AND AGE: TOTAL SEARCH AREA.

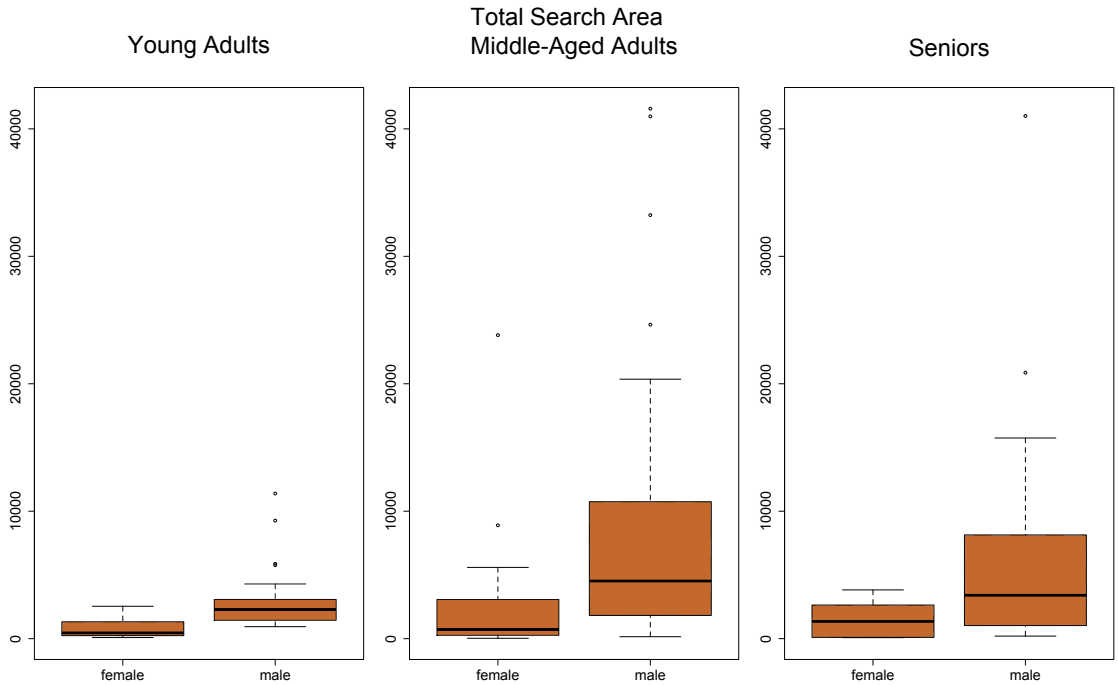


FIGURE 3.18 VARIATION IN SUBSISTENCE ACTIVITY BY GENDER AND AGE: NUMBER OF UNIQUE SEARCH AREAS.

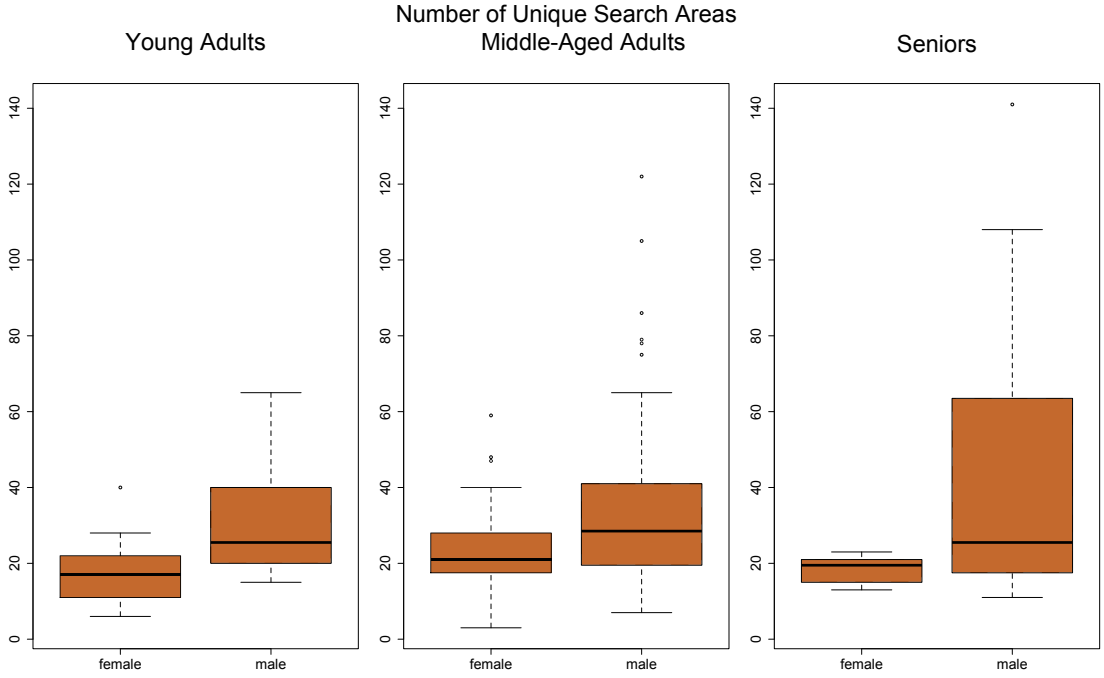
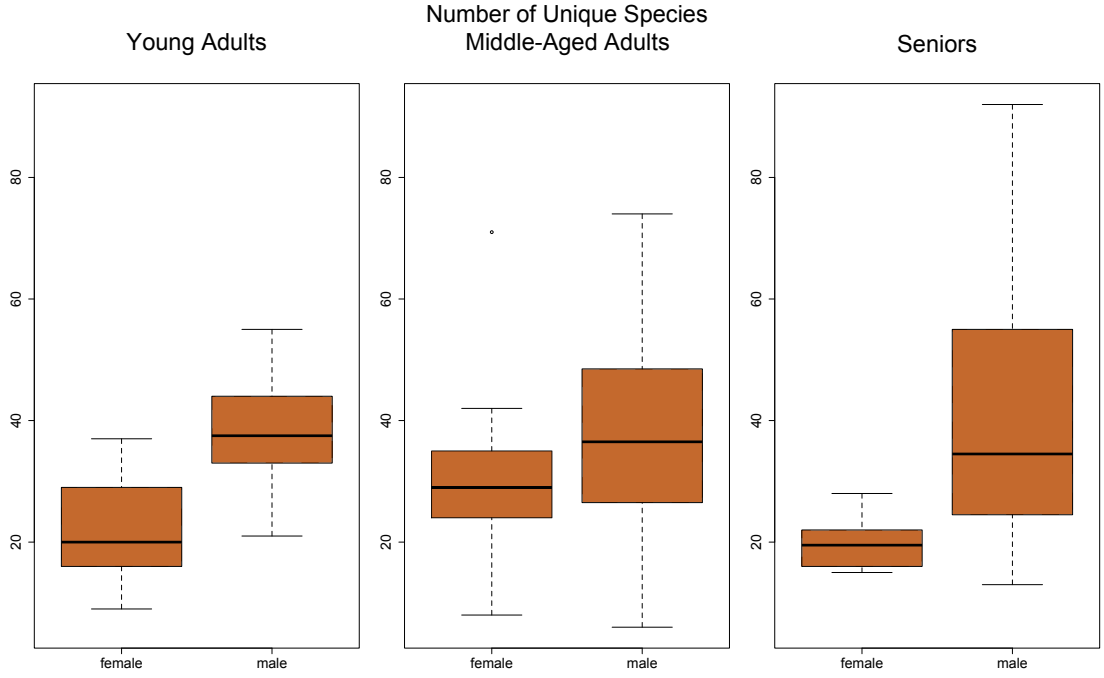


FIGURE 3.19 VARIATION IN SUBSISTENCE ACTIVITY BY GENDER AND AGE: NUMBER OF UNIQUE SPECIES.



1. The complete model included (transformed) search area as the response variable, and (transformed) age, and its square and logarithm, gender, and interactions between gender and the age variables as predictors. As described at the beginning of the chapter, transformations were used to optimize normality of the variables. The model was reduced by iterative deletions and additions of predictors, retaining the model with the lowest value for the Akaike Information Criterion (AIC) after each iteration. The final model was $\text{area}^{0.10} = 1.86 + 0.03\ln(\text{age}^{0.68}) + 0.13\text{gender}(\ln(\text{age}^{0.68}))$, where gender is a dummy variable: 0 for female, 1 for male. Villages were not included as a predictor due to loss of degrees of freedom.
2. Adjusted r^2 increased from 0.25 to 0.26 and there was a reduction in AIC from 41.33 to 41.32.
3. This model was: $\text{area}^{0.10} = 1.95 - 0.03\ln(\text{age}^{0.68}) + 0.10\text{mid} + 0.02\text{senior} + 0.13\ln(\text{age}^{0.68})\text{male}$, where mid, senior, and male are dummy variables with value 1 if true, and 0 otherwise ($p << 0.01$, mult $r^2 = 0.28$).
4. Because the model uses transformed values to stabilize the variance, the residuals in the model are normally distributed (Shapiro-Wilk test, $p = 0.92$). By adding the residuals back into the fitted model that predicts total area at age 89, and computing the inverse transformations, we can recover the variance as well (i.e., how much above or below average they are estimated to be at age 89). For details, the code used to compute these predictions and the bootstrap estimates in the following discussion is provided in Appendix F: "Source Code for Calculating Lifetime Subsistence Estimates."
5. Beginning with a model with the following predictors: (transformed) age and its (natural) logarithm, age range, gender, site, and all 2-way interactions, the model was reduced iteratively according to the Akaike Information Criterion (AIC). In the final model, age (linear term only), gender, site, and the age-site interaction remained, though only gender was significant at the 0.05 level ($p = 0.0022$). For the entire model, $p << 0.001$, mult. $r^2 = 0.49$. The fitted lines in Fig. 3.8 are from the final (reduced) model, using the median coefficient for the site variable.
6. The full model began with all the same predictors as the model for number of unique search areas. Again simplifying the model according to the AIC, gender, site, age range, and gender-site, and gender-age range interactions all remained in the final model
($p << 0.001$, mult. $r^2 = 0.52$).
7. For males, all pairwise differences in age ranges, $p \geq 0.95$ after applying Tukey's honest significant differences; for females, $p \geq 0.41$.
8. For all pairwise comparisons, $p \leq 0.01$.
9. For maximum values (100th percentile), bootstrap estimates are constrained by the fact that they can never estimate a maximum value greater than the maximum observed value. To overcome this limitation we sampled from a kernel density estimate of the distribution rather from the observed variables. This gives a small, but non-zero probability to values greater than the maximum observed values. *See* source code in Appendix F.

Tori Ferguson filleting sheefish. Photo credit: Lena Ferguson.