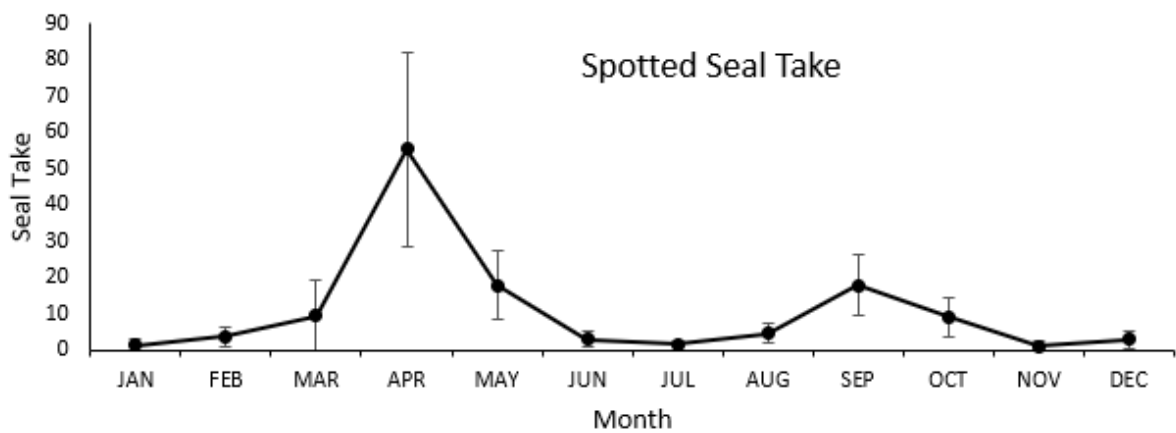
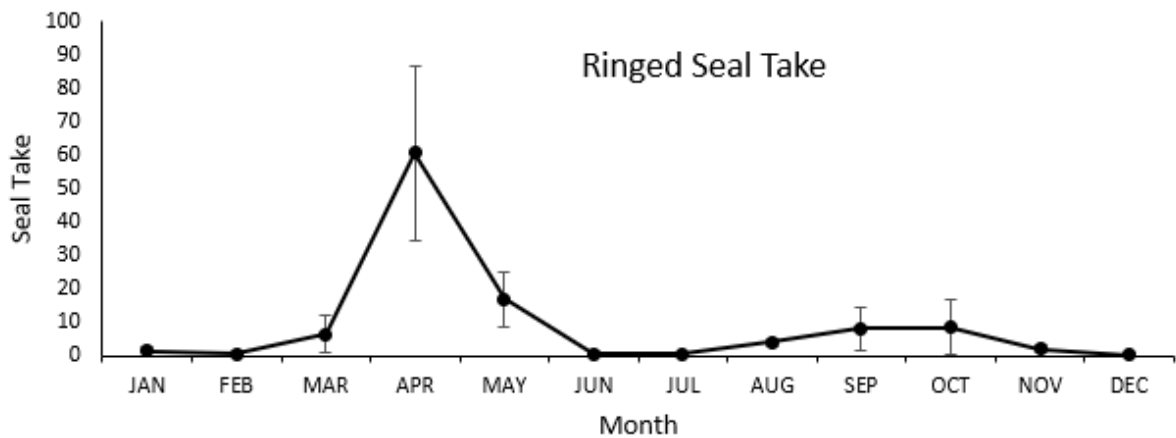
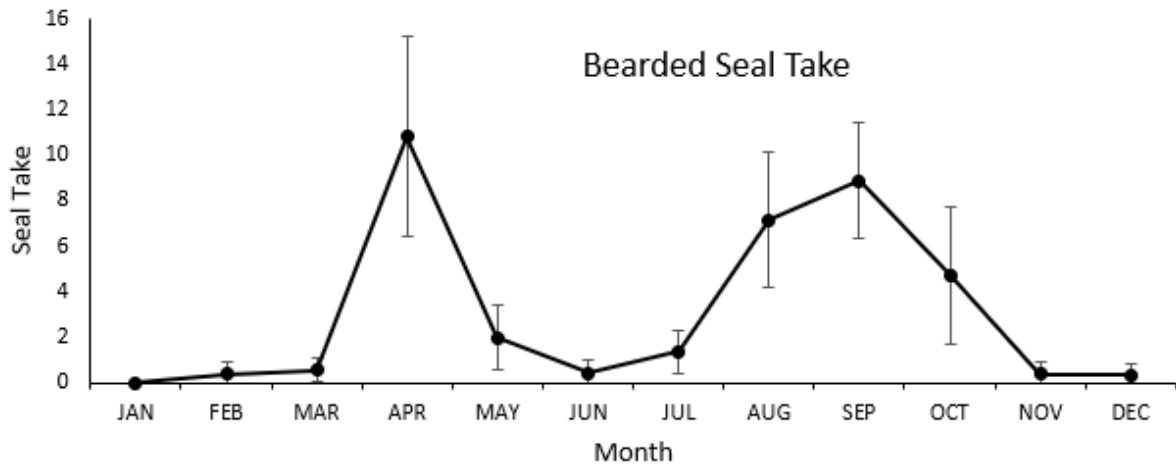


Quinhagak Ice Seal Harvest Report

2008, 2010-2014, 2016 Summary



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Use of harvest data

Due to high variability in seal harvest numbers (among years, within communities, among communities, and within regions), harvest data presented here should not be extrapolated to other communities or regions at this time. For example, during the six-year span of 2011-2016, only 4 of the 64 (6%) coastal communities that harvest ice seals have been surveyed in two consecutive years or more. In addition, hunter concerns regarding the misuse of harvest data make extrapolation of harvest numbers inappropriate at this time. We are working toward a better understanding of harvest variability and community needs by conducting more and consecutive surveys with the goal of being able to report a statewide ice seal harvest in the future. Until then, please contact the Ice Seal Committee for guidance prior to using these harvest data.

Nelson, M., R.J. Adam, J. Olnes, and L. Church. 2018. Quinhagak ice seal harvest report 2008, 2010-2014, 2016 Summary. Report to Quinhagak and the Ice Seal Committee. 16 pp.

Introduction

Bearded (*Erignathus barbatus*), ringed (*Pusa hispida*), spotted (*Phoca largha*), and ribbon seals (*Histiophoca fasciata*) are the species of Alaska's seals collectively called ice seals because of their association with sea ice and their dependence on it for feeding, resting, and pupping. Ice seals are an important component in maintaining Alaska Native subsistence culture because seals are a source of food; skins are used for clothes, boats, and crafts. Hunting, processing, using, and sharing seals is an important part of Alaska Native culture and heritage. To document subsistence needs and to show that harvests are sustainable, the number of seals used by a community should be determined and reported annually. Reporting subsistence seal harvest information by community shows how important seals are to communities and how many are needed. This information is especially important now because climate change or other factors may change the number of seals in a population or change when they are available to hunters. Concerns over how climate change may affect their populations in the future have led to bearded and ringed seals being listed as "Threatened" under the Endangered Species Act. Although the National Marine Fisheries Service (NMFS) has said limiting harvest is not a management action they are pursuing in response to this listing, there is still great concern among subsistence users that harvest will be restricted. Often in situations where no harvest data are available more restrictive decisions are made to protect the resource than would be necessary if good harvest data were available. Learning more about the current level of subsistence harvest of ice seals, which is thought to be sustainable, could also provide valuable information about the size of seal populations where little information is available.

Methods

Project Approval

Quinhagak and two other communities (Tununak and Hooper Bay) were chosen as communities for the harvest monitoring pilot project in 2008 because of their willingness to participate in the project. Hooper Bay and Quinhagak had also participated in a harvest survey project by the Alaska Department of Fish and Game (ADFG), Division of Subsistence during 1997-1999. Having a previous study to compare our results with was important. The Ice Seal Committee (ISC), the Association of Village Council Presidents (AVCP), and the Native Village of Quinhagak were presented with the project goals and all agreed that the project was necessary to show the importance of seals for subsistence needs. The Native Village of Quinhagak approved the project before any surveys were conducted in their community.

Survey Instrument

Based on pilot studies, the most preferred harvest collection method is a household survey. A household survey consists of a survey technician, preferably locally hired, surveying a predetermined number of households in a community. Survey questions are related to the number of seals harvested

by the household. The level of detail varies; some surveys record only the number of each species per year, while others record the number of individuals by sex, month of harvest, struck but lost, and age. The more detailed information is more useful but it makes the surveys take longer and cost more. Ice seals are used for subsistence in five different regions of Alaska, and each region has unique needs, concerns, and desires of the people in that region that should be considered when planning a survey. Sometimes a harvest calendar is provided prior to the survey for people to keep track of their harvest before being surveyed. A household list is used by the surveyor to keep track of which households have been surveyed, but is kept confidential so there is no way to associate the harvest reported to an individual hunter or household.

Survey timing

In Quinhagak, most hunters start hunting when the ice breaks up in the spring and are busy hunting or fishing until after the ocean freezes in the late fall. Therefore, the best time to conduct household surveys is during the winter before the spring breakup. The goal is to begin the surveys after the first of January, to record harvest for the previous calendar year, and have them completed by mid-April. For example, this survey, conducted in March 2017, collected information about seals harvested during the calendar year (Jan-Dec) 2016.

Data Analysis

The completed household survey forms were sent to Mark Nelson at Alaska Department of Fish and Game (ADFG) in Fairbanks. The surveys were counted and checked for completeness, and then the surveyor was paid based on the number of surveys completed. Information from the surveys was entered into a Microsoft Access database and checked for accuracy and duplication. The number of completed household surveys was compared against the total number of households in the community to determine the percentage of households surveyed. The percent surveyed is used to estimate the number of seals harvested by households not surveyed to get a harvest estimate for the entire community. The information is always presented as community estimates and never by household to protect the privacy of individual households.

The information recorded on the household survey forms is the reported harvest and struck but lost. This information is used to calculate estimated harvest and estimated struck but lost for the entire community. We must estimate for the entire community because the surveys do not cover every household in the community and this is how we account for the number of seals used by the households not surveyed. The estimated harvest and the estimated struck but lost are the numbers that are presented in reports because they represent the subsistence needs for the entire community. The total number of seals by species used for subsistence during a particular year is the estimated harvest plus the estimated struck but lost and together is called the “take.” **So “take” as presented in this report refers to the estimated harvest plus the estimated struck but lost.** The formula for estimating the number of seals harvested in the entire community is:

$$e = \frac{R}{\%S}$$

Where “e” is the estimated number of seals harvested, “R” is the reported number of seals harvested, and “%S” is the percentage of households surveyed. For example, during 2014 we surveyed 43% of the households in Quinhagak, %S = 0.43, and they reported harvesting 20 ringed seals (R) then the estimated number harvested would be:

$$e = \frac{R}{\%S} = \frac{20}{0.43} = 46 \text{ ringed seals.}$$

The estimated number of seals harvested is then added to the estimated number of seals struck but lost to determine a total “take” for the community. After obtaining an estimate of total take for several individual years, we can then calculate the average annual take across years and our level of certainty around this estimate. A 95% confidence interval provides a range of numbers within which the actual number of seals taken by the community lies. The more households that are surveyed and the more years that surveys are conducted, the closer the estimate is to the actual number of seals taken by the community or the more precise the estimate is. The confidence interval is calculated by using the formula:

$$CI (\pm) = t_{\alpha/2} \times SE \times FPC$$

where CI stands for confidence interval, “ $t_{\alpha/2}$ ” is the measure of precision you want to use (we will use 95%), “SE” is the standard error of our estimated take, and “FPC” is the Finite Population Correction. The “SE” is calculated by the formula:

$$SE = \frac{SD}{\sqrt{n}}$$

Where “SD” is the standard deviation around our estimate of the take, and “n” is the size of our sample. The standard deviation (SD) is calculated as:

$$SD = \sqrt{\frac{\sum(e_i - \bar{e})^2}{n}}$$

where “ e_i ” is each year’s estimated seal take and “ \bar{e} ” is the average seal take across years. The “FPC” is calculated by the formula

$$FPC = \sqrt{\frac{H-h}{H-1}}$$

where “H” is the total number of households in the community pooled over the years being considered and “h” is the pooled number of households surveyed during those years. The FPC is a way to account for the number of households that were surveyed where the more you survey the narrower your confidence interval becomes (meaning the better your estimate). If the survey contacted every household in the community the FPC would go to zero and the confidence interval would then be equal to the number of seals harvested, meaning that you are 100% positive the number is correct because you are not estimating for households not surveyed.

The number of seals *per capita* is a way to show how many seals were taken per person living in the community during that year. The number of people living in the community changes so to compare current harvest to past harvest we also present the harvest *per capita*. Larger communities are also likely to take more seals for subsistence than smaller communities, but by looking at seals taken per person the level of use by community can be compared. Number of seals *per capita* is calculated by dividing the number of seals by the number of people living in the community. For example, the number of ringed seals taken *per capita* during 2014 equals: 51 (ringed seals taken) divided by 702 (people living in Quinhagak during 2014) = 0.07. This means that Quinhagak took 0.07 ringed seals for every person living in Quinhagak during 2014, or Quinhagak took 1 ringed seal for every 14 people.

The information is presented to the communities by reports, posters, and oral presentations at tribal and community meetings. The numbers must be approved by the community in which they were collected before they can be shared. Once approved, the numbers are included in the annual ice seal harvest report (Nelson 2017) that is presented annually to the ISC.

Results

Households surveyed

The number of households surveyed in Quinhagak ranged from 44 during 2012 to 134 in 2016 (Table 1). The number of households in the community has stayed between 165 (2010 and 2011) and 194 (2016) according to Quinhagak Tribal records and the U.S. Census Bureau records. Only active households (people living in them) were counted toward the total. No surveys were conducted for the 2009 or 2015 harvest years in Quinhagak. The “percent surveyed” from each year is used to extrapolate the reported harvest to the entire community (estimated harvest, estimated struck but lost, and total take). During 2011, law enforcement actions involving fishing in the community likely resulted in reduced participation in surveys. Subsequently the percentage of households willing to participate in the survey declined from more than 60% in 2008 and 2010, to less than 50% for 2011 – 2014. In 2016, 69% of the community was surveyed, possibly indicating improved trust and the recognized importance of the seal harvest information.

Table 1. Population of Quinhagak for 2008, 2010-2014, and 2016, number of households present, number of households contacted, number of households that agreed to participate, and the percentage of the community participating in the survey. Population data is from the U. S. Census Bureau.

Year	Population	Number of households			
		Contacted	Participated	Total	% Surveyed
2008	553	104	104	170	61%
2010	672	104	104	165	63%
2011	686	145	59	165	36%
2012	697	150	44	174	25%
2013	694	137	65	176	37%
2014	702	134	76	176	43%
2016	729	155	134	194	69%

Sharing seals

Households that use seals outnumber households that hunt seals, indicating the importance of seals for the subsistence of the entire community (Table 2). In Quinhagak, a smaller percentage (<20%) of the community used seals in 2016 than in prior years with survey data (Table 2).

Table 2. Percent of households using and actively hunting seals by species. ‘Use’ is the percentage of households hunting or receiving seals. ‘Hunt’ is the percentage of households that reported hunting seals.

	Bearded seals		Ringed seals		Spotted seals		Ribbon seals	
	Use	Hunt	Use	Hunt	Use	Hunt	Use	Hunt
2008	23%	20%	35%	25%	46%	29%	1%	0%
2010	21%	14%	53%	30%	59%	29%	1%	1%
2011	15%	12%	46%	19%	44%	19%	3%	2%
2012	16%	16%	48%	36%	30%	27%	0%	0%
2013	18%	17%	23%	18%	57%	26%	0%	0%
2014	11%	8%	29%	21%	39%	24%	0%	0%
2016	14%	13%	14%	11%	19%	16%	0%	0%
Average	17%	14%	35%	23%	42%	24%	1%	0%

Bearded Seals

The total take of bearded seals ranged from 16 in 2014 to 63 in 2008 and averaged 37 (± 8) seals per year (Table 3). In 2016, the total take of 38 bearded seals was equal to the annual average across survey years. The estimated struck but lost ranged from 0% in most years to 10% in 2010 and averaged 3% (Table 3).

Ringed Seals

The total take of ringed seals ranged from 163 in 2010 to 26 in 2016 and averaged 110 (± 28) seals per year (Table 3). In 2016, the total take of 26 ringed seals was much lower than the annual average across survey years. The estimated struck but lost ranged from 0% in 2013 to 15% in 2010 and averaged 8% (Table 3).

Spotted Seals

The total take of spotted seals ranged from 210 in 2008 to 48 in 2016 and averaged 128 (± 36) seals per year (Table 3). In 2016, the total take of 48 spotted seals much lower than the annual average across survey years. The estimated struck but lost ranged from 6% in 2012 to 19% in 2008 and 2016, and averaged 12% (Table 3).

Ribbon Seals

Two ribbon seals were taken during October in 2010 and three were taken during September in 2011, none of which were struck but lost (Table 3). No ribbon seals were taken in other years.

Table 3. Estimated harvest, estimated struck but lost, percent struck but lost, total take, and the per capita seal take for each species of ice seal for 2008, 2010-2014, and 2016. The bottom line shows the average from all seven years and (\pm number) represents the 95% confidence interval across years.

Bearded Seals						Ringed Seals					
					<i>Per capita</i> total take						<i>Per capita</i> total take
	Harvested	Struck but lost		Total take			Harvested	Struck but lost		Total take	
2008	60	3	5%	63	0.11	2008	98	16	14%	115	0.21
2010	26	3	10%	29	0.04	2010	138	25	15%	163	0.24
2011	26	0	0%	26	0.04	2011	106	11	9%	117	0.17
2012	44	0	0%	44	0.06	2012	132	8	6%	140	0.20
2013	49	0	0%	49	0.07	2013	160	0	0%	160	0.23
2014	16	0	0%	16	0.02	2014	46	5	10%	51	0.07
2016	35	3	8%	38	0.05	2016	25	1	4%	26	0.04
Average	37	1	3%	37 (\pm 8)	0.06	Average	101	9	8%	110 (\pm 28)	0.19
Spotted Seals						Ribbon Seals					
					<i>Per capita</i> total take						<i>Per capita</i> total take
	Harvested	Struck but lost		Total take			Harvested	Struck but lost		Total take	
2008	171	39	19%	210	0.38	2008	0	0	0%	0	0.00
2010	148	31	17%	179	0.27	2010	2	0	0%	2	0.00
2011	72	6	8%	78	0.11	2011	3	0	0%	3	0.00
2012	120	8	6%	128	0.18	2012	0	0	0%	0	0.00
2013	181	14	7%	195	0.28	2013	0	0	0%	0	0.00
2014	51	5	9%	56	0.08	2014	0	0	0%	0	0.00
2016	39	9	19%	48	0.07	2016	0	0	0%	0	0.00
Average	112	16	12%	128 (\pm 36)	0.20	Average	1	0	0%	1 (\pm 1)	0.00

Seasonality

Most hunting of ringed and spotted seals occurs during the spring (April and May), however some are also harvested during the fall (September and October). Bearded seals are hunted during both the spring and fall in Quinhagak. Very little hunting occurs during the winter and summer months, except for a few spotted seals taken during the summer months. Below are tables and figures for each species detailing how many seals were taken (estimated harvest + estimated struck but lost) during each month. The tables show the total take for each month and the average of that month for the seven years with a 95% confidence interval. The figures show the average number of seals taken each month and the associated 95% confidence interval.

Table 4. The number of bearded seals taken (estimated harvest + estimated struck but lost) by Quinhagak each month during 2008, 2010-2014, and 2016, including the average with a 95% confidence interval. Total take values with * indicate seals were taken in which the month of harvest is unknown.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
2008	0	0	2	24	6	0	0	11	16	3	0	0	63
2010	0	0	0	13	0	0	0	5	8	3	0	0	29
2011	0	0	0	6	3	3	0	0	14	0	0	0	26
2012	0	0	0	4	0	0	4	16	8	12	0	0	44
2013	0	3	0	19	0	0	3	5	3	14	3	0	49
2014	0	0	2	2	0	0	0	2	5	0	0	2	16*
2016	0	0	0	7	4	0	3	10	9	1	0	0	38*
AVERAGE	0	1 (±1)	1 (±1)	11 (±4)	2 (±1)	0 (±1)	1 (±1)	7 (±3)	9 (±3)	5 (±3)	0 (±1)	0 (±0)	37 (±8)

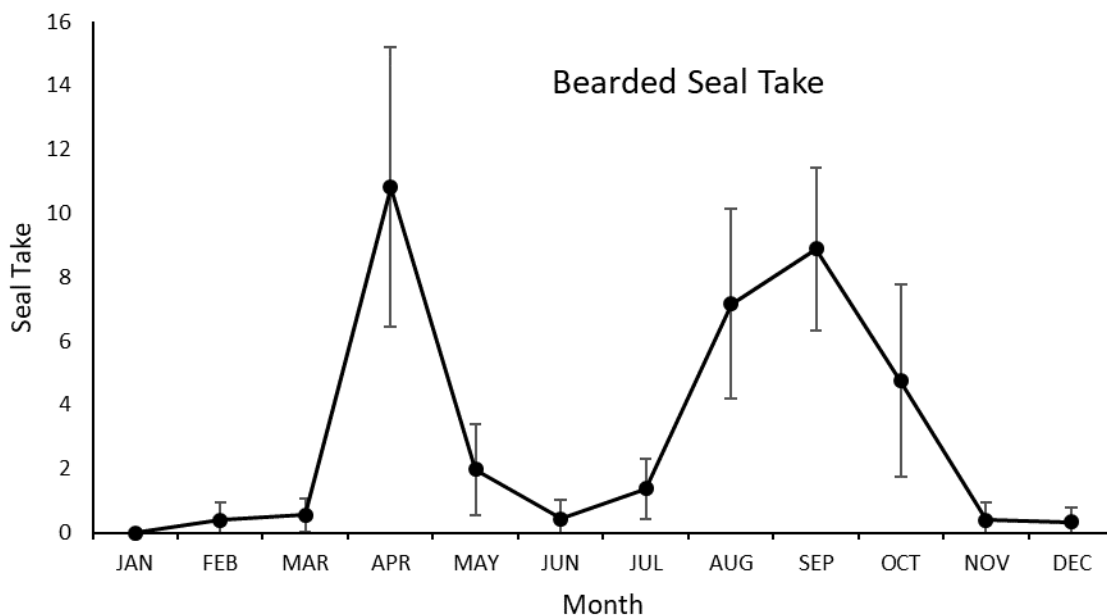


Figure 1. Average bearded seal take for each month by Quinhagak from 2008, 2010-2014, and 2016 with a 95% confidence interval.

Table 5. The number of ringed seals taken (estimated harvest + estimated struck but lost) by Quinhagak each month during 2008, 2010-2014, and 2016, including the average with a 95% confidence interval.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total Take
2008	0	0	27	44	16	0	2	6	16	0	3	0	115
2010	0	0	0	141	13	0	0	5	5	0	0	0	163
2011	0	0	0	103	14	0	0	0	0	0	0	0	117
2012	0	0	0	48	48	4	0	4	32	4	0	0	140
2013	3	0	11	73	22	0	0	5	0	43	3	0	160
2014	7	5	5	9	2	0	0	2	2	9	7	2	51
2016	0	0	3	7	3	0	1	6	1	3	1	0	26
AVERAGE	1 (±1)	1 (±1)	7 (±5)	61 (±26)	17 (±8)	1 (±1)	0 (±0)	4 (±1)	8 (±6)	8 (±8)	2 (±1)	0 (±0)	110 (±28)

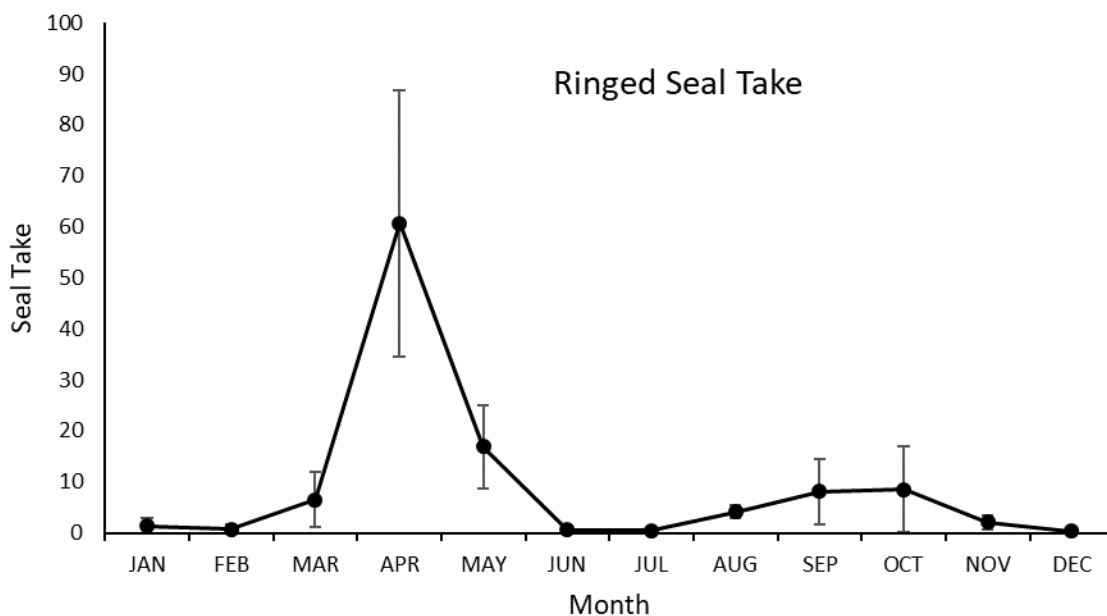


Figure 2. Average ringed seal take for each month by Quinhagak from 2008, 2010-2014, and 2016 with a 95% confidence interval.

Table 6. The number of spotted seals taken (estimated harvest + estimated struck but lost) by Quinhagak each month during 2008, 2010-2014, and 2016, including the average with a 95% confidence interval.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total Take
2008	0	13	50	76	19	2	5	16	26	3	0	0	210
2010	0	0	0	146	19	0	2	2	11	0	0	0	179
2011	0	0	0	31	11	3	0	3	19	3	0	8	78
2012	0	0	0	28	16	12	4	0	48	20	0	0	128
2013	3	8	0	87	54	0	0	5	0	27	0	11	195
2014	7	2	9	5	0	2	0	5	9	7	7	2	56
2016	0	3	6	14	6	1	1	1	12	3	0	0	48
AVERAGE	1 (±1)	4 (±3)	9 (±10)	55 (±27)	18 (±9)	3 (±2)	2 (±1)	5 (±3)	18 (±8)	9 (±6)	1 (±1)	3 (±2)	128 (±36)

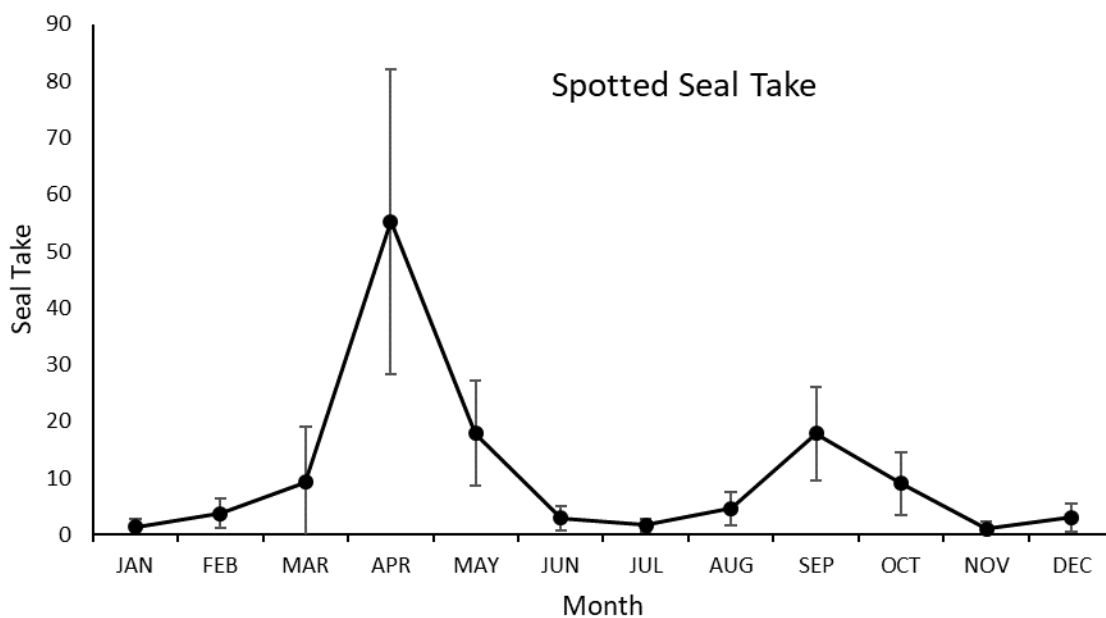


Figure 3. Average spotted seal take for each month by Quinhagak from 2008, 2010-2014, and 2016 with a 95% confidence interval.

Hunt Frequency

Supplemental questions regarding the amount of time spent hunting were included in all years of the survey (Table 7). Very few households reported hunting more than in the past, a wide variety of reasons were given for hunting less (e.g., less time, higher gas prices, bad weather).

Table 7. Did you hunt more often this year than last year? Of households that hunt, the percent reporting whether they hunt more, same, or less in Quinagak (*n* is the number of households answering this question).

	Did you hunt more or less often?			<i>n</i>
	More	Same	Less	
2008	3%	54%	43%	99
2010	4%	34%	62%	89
2011	8%	43%	49%	51
2012	0%	48%	52%	33
2013	0%	30%	70%	43
2014	0%	53%	47%	32
2016	3%	58%	40%	40
Average	3%	46%	52%	55

Seal health

Subsistence hunters and processors have extensive experience handling seals and know when an animal looks sick or unhealthy. A supplemental question was added in 2011 to collect information on the number of unhealthy seals a household encountered. During 2011, all households that responded to this question reported that ringed, bearded, and ribbon seals they encountered were healthy. Some (8%) reported that some spotted seals were not healthy. During 2012 and 2013, all households reported that all seals were healthy. In 2016, households were not specifically asked about seal health, however, two respondents commented on seeing sick seals. It is worth noting that during 2011 and 2012 there was an Unusual Mortality Event (UME) where numerous ringed seals were found to be sick with symptoms including hair loss and sores around the eyes, nose and flippers. Many of these seals were found on the beach and unafraid of people. More information about this can be found at the NOAA website <http://www.nmfs.noaa.gov/pr/health/mmume/>.

Discussion

Sea ice and weather

Changes in the total take from year to year are mostly due to sea ice and weather conditions. This variability increases the confidence interval around our estimate of the average annual take. Lower total seal takes in 2014 and 2016, and for ringed seals in particular, may in part be explained by rapid sea ice retreat in the spring of both years. Years in which the spring ice stays longer provides more opportunity to hunt seals, especially bearded and ringed seals. Once the ice moves offshore and recedes to the north, ringed and bearded seals tend to move with it, decreasing their availability to hunters. When the sea ice breaks up quickly, the spring hunt is shortened, and if bad weather (e.g., wind, waves, fog, or snow) also occurs, hunters may have little opportunity to hunt. During fall, as freeze-up occurs there can be bigger storms and bad weather, but there is also more time to wait for better weather than in spring.

Comparing to past harvest surveys

A seal and sea lion harvest survey was conducted by ADFG, Division of Subsistence in three communities (Hooper Bay, Emmonak, and Quinhagak) in the Yukon Kuskokwim Delta region during 1997-1998 and 1998-1999 (Coffing *et al.* 1998, 1999). The reported harvest and reported struck but lost was estimated for the entire community, and from that estimate, total take for each species was calculated (Table 8). However, these surveys used 1 March to 28 February as the definition of the year making direct comparison of survey results more difficult. This is an example of why comparing information between surveys conducted using different methods needs to be done with caution.

Bounty Data

Prior to 1973, the State of Alaska implemented a bounty on seals in some areas of the state (Table 8). The bounty was implemented to reduce harbor seal numbers to protect commercial fish stocks from predation in the Gulf of Alaska and, although there was no commercial fishing farther north, the bounty was implemented on ice seals anyway and provided the first ice seal harvest data. Comparing the current levels of take to data collected during the bounty years could provide insights to the overall change in seals taken over the last 40 or 50 years. The information collected during the bounty was rarely reported by species and more often reported as the total number of seals turned in for bounty per year by community. Comparing bounty data to harvest survey data has some possible problems because the information was collected in different ways with different objectives (Nelson 2017). For example, the ~\$3 bounty amount may have been enough of a monetary incentive to take more seals than normal. However, by keeping these differences in mind, we may be able to determine if changes in harvest numbers are due to changes in seal availability, subsistence needs, hunter effort, sea ice, weather, or something else.

Table 8. Number of people, survey method and quality rating, total take (estimated take + estimated struck but lost) for each species, total take for all species combined, and the per capita total take (total take / number of people) for all years with available data in Quinhagak, Alaska. The 1962-1972 data is from Alaska Marine Mammals reports (Burns et al. 1964, Burns 1967-1970, 1972, 1973), the 1982 data is from Wolfe et al. (1983), the 1997-1999 data is from the ADFG Division of Subsistence (Coffing et al. 1998, 1999), and the 2008, 2010–2014 and 2016 data is from this study (Nelson and Church 2015).

Year	People	Method		Number of seals				Total take	Per capita take
		Type	Rating	Bearded	Ringed	Spotted	Ribbon		
1962	320	bounty	good	-	-	-	-	0	0.00
1966	320	bounty	good	-	-	-	-	157	0.49
1967	320	bounty	good	-	-	-	-	21	0.07
1968	320	bounty	good	-	-	-	-	64	0.20
1969	320	bounty	good	-	-	-	-	185	0.57
1970	340	bounty	good	-	-	-	-	205	0.60
1971	340	bounty	good	-	-	-	-	150	0.44
1972	340	bounty	good	-	-	-	-	100	0.29
1982	412	household	good	65	114	286	0	465	1.13
1998	567	household	good	34	120	125	2	281	0.50
1999	612	household	good	19	13	66	1	99	0.16
2008	553	household	good	63	115	210	0	388	0.70
2010	672	household	good	29	163	179	2	373	0.56
2011	686	household	good	26	117	78	3	224	0.33
2012	697	household	good	44	140	128	0	312	0.45
2013	694	household	good	49	160	195	0	404	0.58
2014	702	household	good	16	51	56	0	123	0.18
2016	729	household	good	38	26	48	0	112	0.15

Conclusion

The total number of seals taken by Quinhagak hunters has varied widely across survey years (Table 8). In general, the total take has slightly increased from the bounty era to the present. Because the population of Quinhagak has also increased over this time, the *per capita* take has stayed relatively constant, averaging 0.4 seals per person. In 2014 and 2016, however, seals were taken at less than half the average rate across years (< 0.20 seals per person). The primary reason given by survey respondents was that they were busy working. This result highlights how external factors, including job opportunities or fuel prices, influence the ability of community members to partake in subsistence activities. We should continue to monitor the number of ice seals needed for subsistence to accurately document the needs of each community and to monitor whether climate change and other factors affect the availability of ice seals for hunters.

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