DIVISION OF SUBSISTENCE
Alaska Department of Fish and Game
November 2019

Food Production and Nutritional Values of Noncommercial Fish and Wildlife Harvests in Alaska

1. Introduction: Purpose, Methods, Limitations

Purpose

Since the late 1970s, the Division of Subsistence of the Alaska Department of Fish and Game (ADF&G) has conducted studies and compiled information on noncommercial harvests and uses of fish, wildlife, and wild plants in all areas of the state (Wolfe and Walker 1987; ADF&G 1989; Fall 1990; 2016; 2018; ADF&G 2019; Magdanz et al. 2016).[1] Interest is high in the role wild resource harvests play in supplying nutritious foods and supporting food security (e.g. Inuit Circumpolar Council - Alaska 2015; Fall and Kostick 2018), an interest that extends beyond Alaska. For example, the Wild Harvest Initiative is a multi-year project, begun in 2015, that is compiling data from all 50 states and all Canadian provinces and territories to measure the biomass of wildlife and fish harvested in noncommercial fisheries and hunts[2] and to assess the nutritional and economic value of this harvest (Conservation Visions 2016; https://www.conservationvisions.com/wild-harvest-initiative). Such a continent-wide summary has never been done, but much of the data compilation and analysis proposed by the Wild Harvest Initiative has been accomplished for Alaska through ADF&G and other studies. This report provides a brief overview of some of these studies' findings.

Because of important differences in use patterns and data sources, this overview summarizes fish and wildlife harvests and their associated food and nutritional values for two broad categories of Alaska communities, urban and rural. This approach is consistent with the directive in the State of Alaska's subsistence statute that the Joint Board of Fisheries and Game identify "nonsubsistence areas," where "dependence upon subsistence [hunting and fishing] is not a principal characteristic of the economy, culture, and way of life of the area or community" (Alaska Statute 16.05.258(c)). We refer to these nonsubsistence areas, which are relatively populous with developed cash economies, as "urban areas" in this overview. Subsistence fisheries and hunts are not permitted in nonsubsistence areas, but residents of these areas may participate in authorized state subsistence fisheries and hunts elsewhere in the state. Personal use[3] and sport fisheries and general

1. The Alaska Legislature created ADF&G's Division of Subsistence in 1978 to collect and compile information about all aspects of subsistence hunting and fishing in the state and to make that information widely available (AS 16.05.094; Fall 1990). The division uses social science methods, such as systematic household surveys, mapping, key respondent interviewing, and participant observation. All research is guided by ethical principles established by the National Science Foundation, the Alaska Federation of Natives, and the State of Alaska, including community approval, informed consent, confidentiality, and community review of study findings. Most projects are partnerships with other agencies, tribes, or nonprofit service organizations. Local residents are hired and trained to assist with projects.
2. Publications and presentations about the Wild Harvest Initiative refer to the importance of harvests by "recreational hunters and anglers" (e.g., Conservation Visions 2016:1). In Alaska, subsistence fishing and hunting, as customary and traditional activities, are distinguished in state and federal laws and regulations from sport fishing, personal use fishing, commercial fishing, general hunting, and sport hunting (Fall 2019). Because all of these activities provide harvests for food, we include harvests from all the noncommercial regulatory categories in this summary.
3. Personal use fisheries are nontraditional fisheries that mostly take place in nonsubsistence areas that provide Alaska residents an opportunity to harvest fish with efficient gear, such as gillnets or dip nets, rather than rod and reel in sport fisheries.

Plate 1.–A fish camp on the Salmon River, upper Kuskokwim River drainage, Alaska, 2009. Such camps provide contexts where families work together to harvest and process wild foods, and teach traditional knowledge, skills, and values across generations. Photo by James Van Lanen, ADF&G.

hunts occur in nonsubsistence areas. Outside nonsubsistence areas, referred to here as "rural areas," subsistence harvests are a principal component of the economy, culture, and way of life. Because 83% of Alaska's population lives in nonsubsistence areas (Fall 2019), statewide averages obscure critical differences in the economic and sociocultural role of wild resource harvests across the state, such as harvest levels, harvest methods, composition of harvests, nutritional values, and food replacement costs.

Although a vital component of the food supply in Alaska, the significance of harvests of fish and wildlife in the state exceeds their economic value. In hundreds of Alaska communities, sharing of fish and wildlife harvests with relatives, friends, elders, and people in need, and in community events, is a key cultural value (e.g. Kofinas et al. 2016). Families work together to harvest and process wild foods. Essential skills and traditional knowledge are taught across generations. Participants in these activities learn key values, including nonwasteful and efficient harvesting, and respect for the fish and wildlife upon which their ways of life depend (Plate 1). For more detail on the sociocultural context of subsistence hunting and fishing in contemporary Alaska, see, for example, Fall et al. 2010; Van Lanen et al. 2012; Hutchinson-Scarbrough et al. 2016, all reports within the Division of Subsistence Technical Paper Series http://www.adfg.alaska.gov/sf/publications/.

Methods and Limitations

Harvest estimates for communities outside the nonsubsistence areas are based primarily on the results of comprehensive, in-person household surveys. Of 264 rural places in Alaska, the most recent data for 219 (83%) are included in the estimates presented here. Because household surveys are not conducted on a regularly scheduled basis, estimates do not reflect annual fluctuations in harvest levels, especially when rapid changes, such as those related to climate change or regulatory actions, are occurring. Also, for some areas, we must rely on data that are 10 or more years old to estimate regional patterns. For more information on harvest survey methods and analysis of survey data, see Fall 1990, Fall 2016, and ADF&G 2019. For de-

tailed survey findings at a community level, see the Community Subsistence Information System (CSIS) on-line database http://www.adfg.alaska.gov/sb/CSIS/ (with over 500 community/study year data sets) and the Division of Subsistence Technical Paper Series http://www.adfg.alaska.gov/sf/publications/ (with over 400 titles).

Harvest estimates for residents of nonsubsistence areas are based on recent data from the many annual harvest monitoring programs for salmon and big game, the mailed survey of sport fishing license holders conducted by ADF&G's Division of Sport Fish, and more limited programs for marine mammals and marine invertebrates (Fall 2016, ADF&G 2019). Comprehensive data are not available for small game, birds, most shellfish, and wild plants, but these latter categories likely provide only a very small portion of urban harvests.

Note that estimated harvests represent food production from wild resources and not food consumption rates. Nevertheless, harvest estimates are a reliable surrogate for consumption rates for communities, areas, and the state overall in that they represent the amount of available wild food (Wolfe and Utermohle 2000; Polissar and Neradilek 2018).

In Alaska, most wild foods cannot be adequately replaced by purchases in stores. There is no commercial harvest or sale of many traditional foods, such as marine mammals or big game. Purchased substitutes do not match the nutritional value of wild foods (ANTHC 2008). In rural areas, where cash incomes are low, imported food is often in limited supply and is always expensive. However, if these wild harvests ceased, other sources of food would be needed. The costs of alternative sources of animal protein vary widely; here we have used a replacement cost of $5–$10/pound.[4,5,6]

As noted by Wolfe and Walker (1987; also Goldsmith 2007), noncommercial fish and wildlife harvests are part of Alaska's "hidden economy," in that this food production is rarely acknowledged in indices of economic growth, social welfare, or development policies.

2. Wild Resource Harvests by Residents of Communities Outside Nonsubsistence Areas

Harvests of fish, wildlife, and wild plants by Alaskans living outside nonsubsistence areas produced about 34 million lb of food in the mid-2010s: about 276 lb per person annually. This production provided about 176% of protein requirements (as recommended by the US Department of Agriculture [USDA & U.S. HHS 2010]) for the rural population and about 25% of the caloric needs (Table 1). Salmon comprised the largest portion of the rural wild resource harvest (32.3% of pounds usable weight), followed by land mammals (21.9%), other fish (21.4%), marine mammals (14.4%), wild plants (4.1%), shellfish (3.1%), and birds and eggs (2.8%) (Figure 1; plates 2–5). At $5 to $10 a pound, the cost to replace these wild food harvests in rural Alaska would be about $170–$340 million.

Rural harvest patterns vary by area. Harvests ranged from 145 lb per person in rural Southcentral communities (most of which are connected by roads to Alaska's population centers) to 402 lb per person in the remote, roadless Arctic region. Salmon and other fish ranked either first or second in all areas except the

4. In December 2018, 80% lean ground beef cost $4.99/lb in an Anchorage supermarket; Pacific cod filets were $9.99/lb and sockeye salmon filets cost $13.49/lb. Costs of groceries in rural Alaska places are much higher than those in more populous areas. For example, the cost of groceries for one week for a family of four in Anchorage in December 2017 was $217; the cost in Bethel was $381 and in Kotzebue $463 (Fried 2018:12).
5. We have not addressed the costs of wild food production in this report. An analysis conducted for ADF&G by ECONorthwest (2014) estimated that in 2011, 96,000 Alaska households took 770,000 trips specifically for hunting, spending $1.065 billion, an average of about $1,383 per trip. How costs vary by region and type of harvest activity is a key topic for future research.
6. For a case study of the economic value of subsistence hunting and fishing, see ResourceEcon et al. (2011). For discussions of methods for valuing subsistence activities, see, for example, Brown and Burch (1992), Duffield (1997), and Langdon (2011).

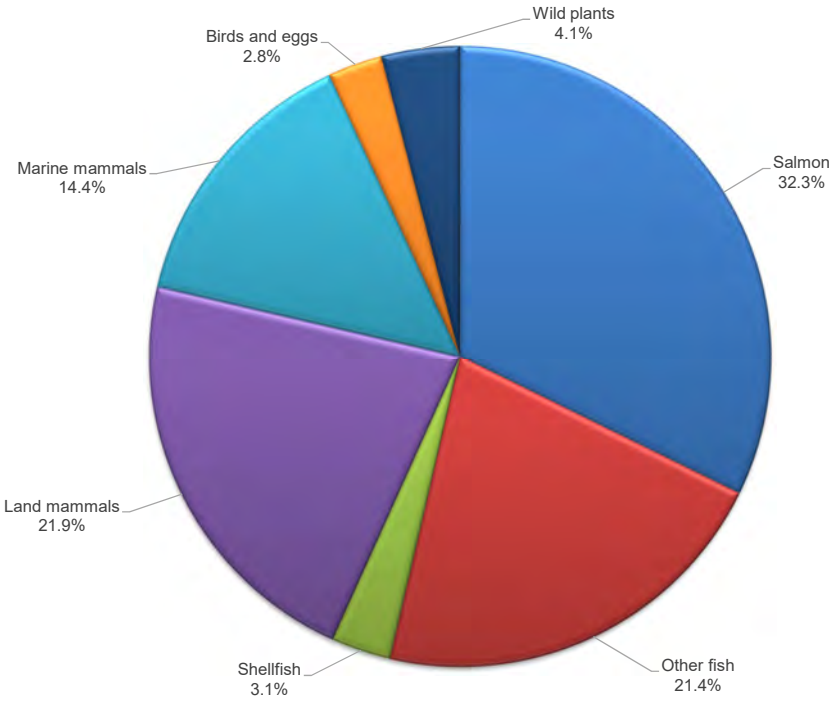
Arctic, where marine mammals are the largest category of wild foods (Figure 2). In rural Alaska, most fish are harvested under subsistence regulations with nets, seines, or fish wheels, but rod and reel (under either or both subsistence or sport regulations) and retention from households' commercial harvests are also important in some areas. More detail is available in ADF&G 2019 (at the area level) and CSIS (at the community level).

Table 1.–Estimated harvests of wild resources and nutritional values, rural areas of Alaska, mid-2010s.

	Estimated harvests		Percent of population's required:	
Area	Total pounds	Pounds per capita	Protein (46 g/day)	Calories (2100 kcal/day)
Rural Southcentral	1,032,896	145.2	92.7%	13.0%
Kodiak Island	2,106,866	158.6	101.3%	14.2%
Rural Southeast	4,996,351	185.8	118.7%	16.6%
Southwest	3,331,143	209.9	134.1%	18.8%
Rural Interior	2,797,785	293.3	187.3%	26.2%
Western	9,427,608	378.7	241.9%	33.8%
Arctic	10,269,886	402.3	256.9%	35.9%
All rural	33,962,534	275.8	176.2%	24.6%

Source: Fall 2018, ADF&G 2019.

Figure 1.–Composition of wild food harvest by rural Alaska residents, mid-2010s



3. Nonsubsistence Areas

Total harvests, composition, and nutritional contribution

Residents of Alaska's nonsubsistence (urban) areas harvested an estimated 11.4 million lb of fish and wildlife resources in the mid-2010s, about 18.6 lb per capita. This harvest provided 11.9% of daily protein requirements and 1.7% of daily caloric requirements for residents of Alaska's most populous areas. Harvests ranged from 14.8 lb per person for residents of the Anchorage Municipality to 38.2 lb per person for Valdez (Table 2).

In the mid-2010s, harvests by residents of nonsubsistence areas were composed of 42.4% salmon, 39.5% large land mammals, 17.4% fish other salmon, 0.7% shellfish, and 0.1% marine mammals. Comprehensive harvest estimates are not available for small game, birds, or wild plants (Figure 3).

At $5 and $10 a pound, the cost to replace this urban harvest with store-bought foods would be about $57–$114 million. The cost to replace the total estimated wild food harvest by all Alaska communities (about 45 million lb) would be $227–$454 million.

Wildlife

Harvests of large land mammals made up about 39.5% of the total usable pounds harvested of fish and wildlife by residents of Alaska's nonsubsistence areas in the mid-2010s, or about 7.4 lb per person. Three species made up most of the harvest: moose (60.6% as estimated in pounds usable weight), caribou (14.0%), and deer (19.9%) (Figure 4). These big game harvests provided 4.7% of protein requirements and 0.7% of caloric requirements for residents of the nonsubsistence areas.

Alaskans harvest most of the big game taken in the state, about 88.5% of total pounds harvested in 2015–2017. Nonresidents harvested most of the brown bears; other species for which nonresidents took more than 10% of the total harvest included Dall sheep (35.8%), black bears (33.5%), mountain goats (28.8%), and moose (11.3%) (Figure 5).

Salmon and other fish

Salmon made up 42.4% of the total usable pounds harvested of fish and wildlife by residents of Alaska's nonsubsistence areas in the mid-2010s, or about 7.9 lb per person. About 47% of this total was harvested in sport fisheries, 46% in personal use fisheries, and 7% in subsistence fisheries. Personal use fisheries provided the majority of the salmon for Anchorage, the Mat-Su Valley, and Fairbanks, and 43% for the Kenai Peninsula; sport fisheries provided most of the salmon for Juneau, Ketchikan, and Valdez (Figure 6). These patterns were similar to those of 2007–2011: in those years, for all nonsubsistence areas, 46% of salmon were taken in sport fisheries, 45% in personal use fisheries, and 7% in subsistence fisheries. with about 50% of the total salmon for Anchorage, Kenai, Mat-Su, and Fairbanks produced in personal use fisheries (Fall 2013:18–22). In the mid-2010s, salmon harvested in subsistence, sport, and personal use fisheries provided about 5% of protein requirements and 0.7% of caloric requirements for residents of Alaska nonsubsistence areas.

For the 24-year period 1994–2017, about 98% of Alaska's salmon harvest (180.226 million salmon/year) was harvested in commercial fisheries (Figure 7), although the portion of the harvest taken in commercial, subsistence, sport, and personal use fisheries varies widely by species and management area. For example, pink salmon, primarily from hatchery production, made up 64% of Alaska's salmon harvest during that period. For more information on salmon and salmon harvests in Alaska see the ADF&G website

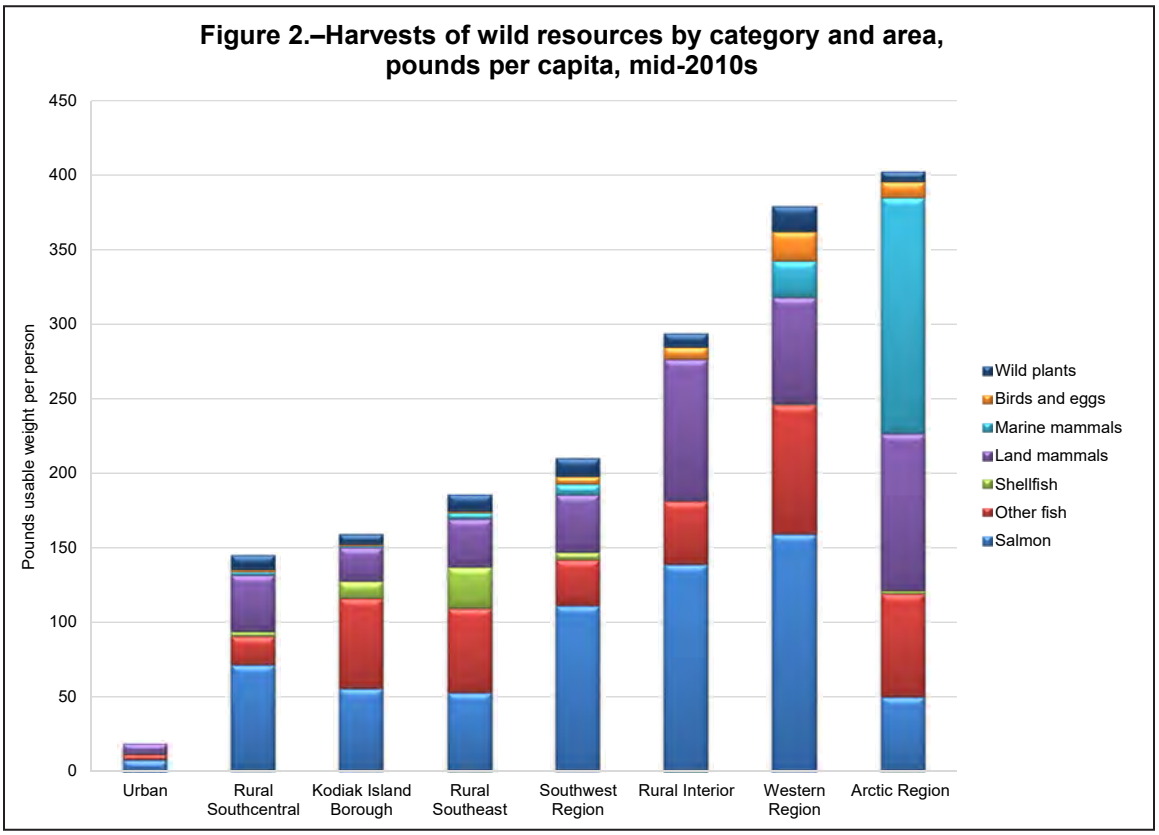


Table 2.–Estimated harvests of wild resources and nutritional values, Alaska nonsubsistence areas, mid-2010s

	Estimated harvests		Percent of population's required:	
Area	Total pounds	Pounds per capita	Protein (46 g/day)	Calories (2100 kcal/day)
Anchorage Municipality	4,447,633	14.8	9.5%	1.3%
Fairbanks Nonsubsistence Area	1,713,258	16.4	10.5%	1.5%
Juneau Nonsubsistence Area	686,167	20.9	13.3%	1.9%
Mat-Su Nonsubsistence Area	2,257,007	22.1	14.1%	2.0%
Ketchikan Nonsubsistence Area	359,357	26.0	16.6%	2.3%
Kenai Peninsula Nonsubsistence Area	1,829,072	32.0	20.5%	2.9%
Valdez City	151,750	38.2	24.4%	3.4%
All Nonsubsistence Areas	11,444,244	18.6	11.9%	1.7%

Sources: Fall 2018, ADF&G 2019

Figure 3.–Composition of fish and wildlife harvests, residents of Alaska nonsubsistence areas

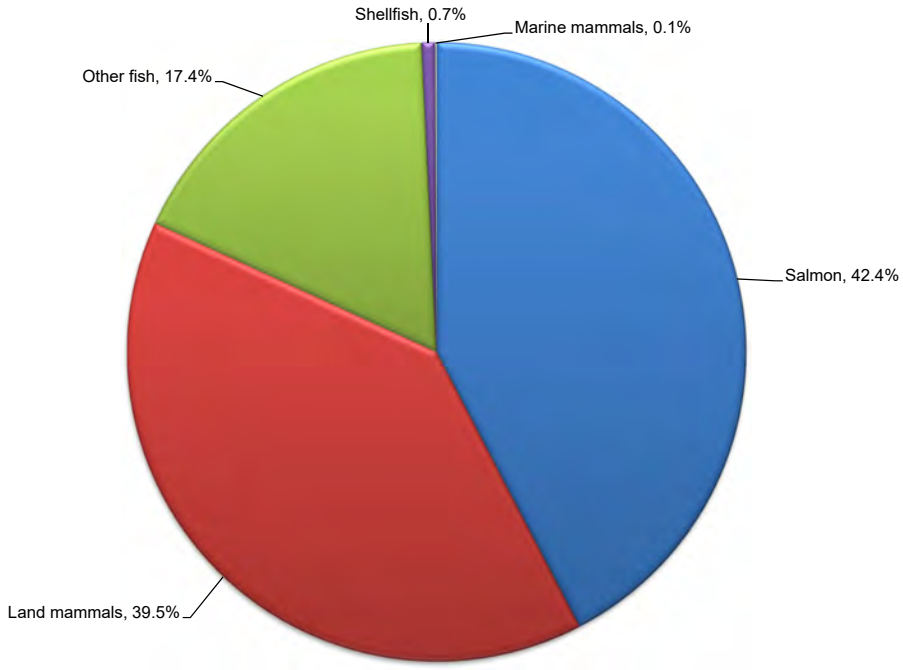


Figure 4.–Composition of reported big game harvest in Alaska, pounds usable weight, by species, three-year average, 2015–2017, residents of Alaska nonsubsistence areas

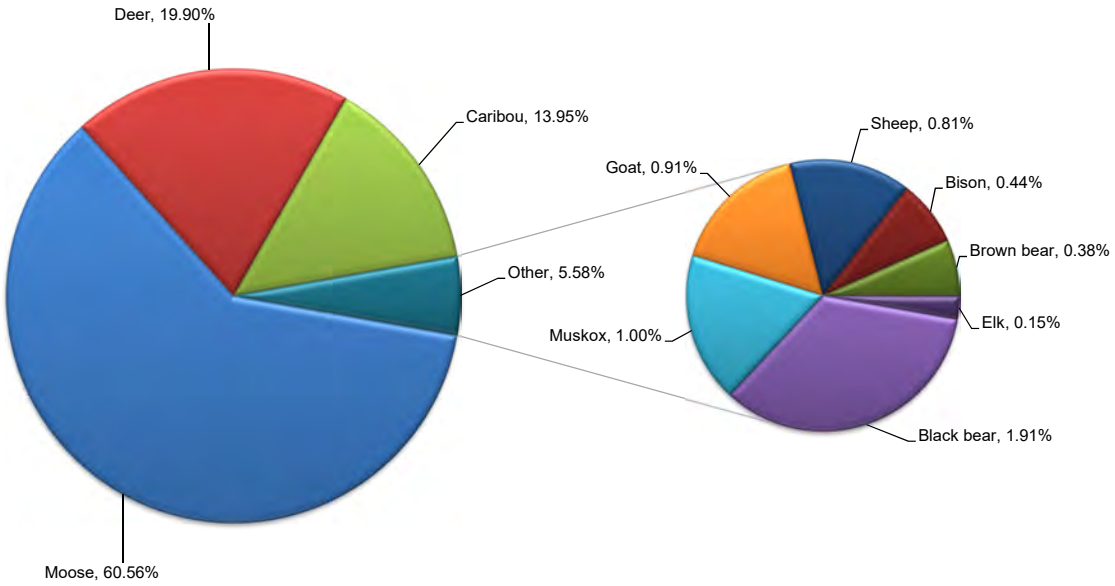


Figure 5.–Percentage of reported harvest of big game species by Alaska residents and nonresidents, 3-year average, 2015–2017

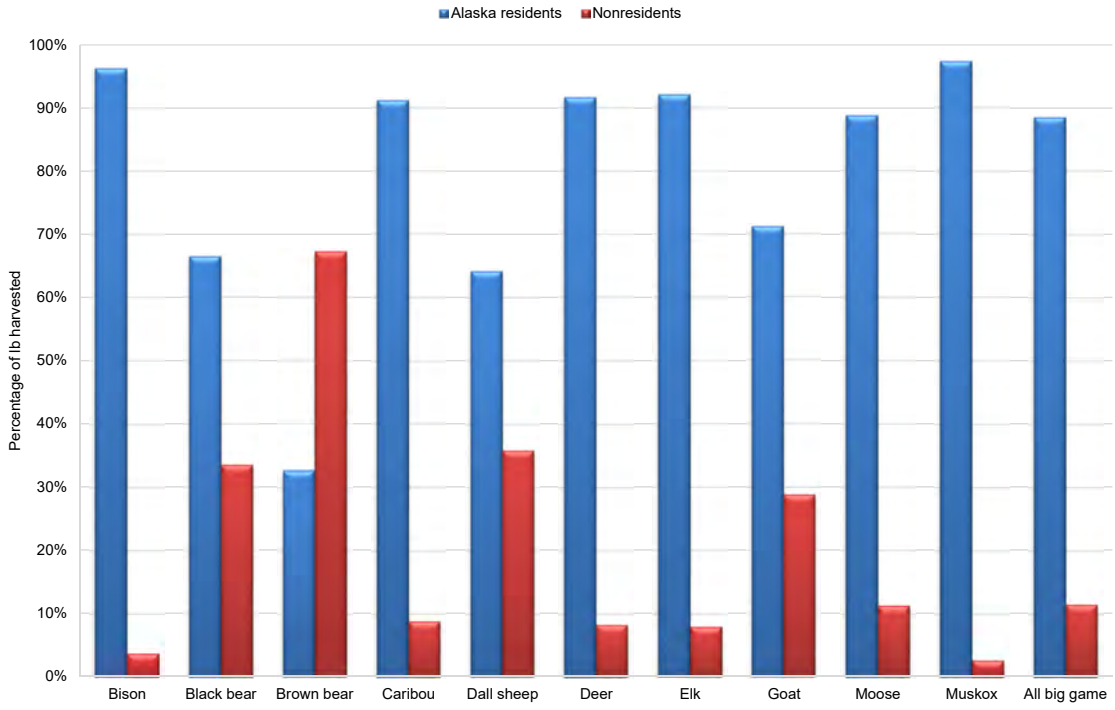


Figure 6.–Salmon harvest for home use by type of fishery, residents of Alaska nonsubsistence areas, pounds usable weight, 3-year average, 2015–2017

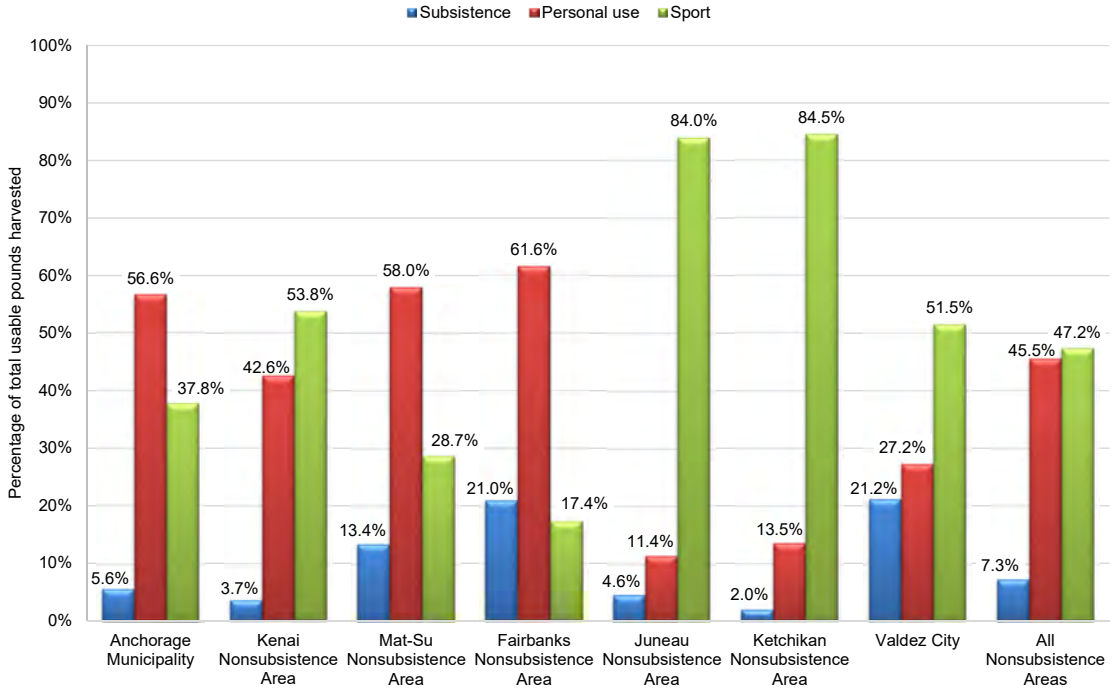


Plate 2.–Subsistence harvest of caribou from the Mulchatna Herd near Igiugig, Alaska, 2017. Caribou rank high as a wild food source in many areas of Alaska. Photo by James Van Lanen, ADF&G.

http://www.adfg.alaska.gov/index.cfm?adfg=fishingCommercial.main and the website of the recently completed State of Alaska's Salmon and People (SASAP) project https://alaskasalmonandpeople.org/ .

A study of how Kenai Peninsula residents obtain local seafood found that households with higher incomes (above $50 thousand/year) were most likely to cite their own fishing activities as their primary source of fish, while lower income households relied more frequently on sharing, barter, or trade (Loring et al. 2013:21). This study concluded that improving the distribution and marketing of commercially harvested local seafood at an affordable price, rather than enhanced noncommercial harvest opportunities, would be the best way to improve food security for Kenai Peninsula residents (Loring et al. 2013:24–25).

Fish other than salmon made up 17.4% of the total usable pounds harvests of fish and wildlife by residents of Alaska's nonsubsistence areas in the mid-2010s, or about 3.2 lb per person. Almost all of this harvest is produced in sport fisheries. Other fish provide 2% of protein requirements and 0.3% of caloric requirements for residents of Alaska's most populous areas.

4. Other Estimates and Trends

The harvest estimates provided here can be compared with other recent estimates. Titus, Haynes, and Paragi (2009:4–5) reported an annual average harvest of 7,260 moose in Alaska over the period 1987–2007, as well as 27,000 caribou and 15,900 deer. Using the 2007 estimated population of the state (676,056), this represents a per capita harvest of 5.3 lb of moose, 6.8 lb of caribou, and 1.7 lb of deer, for a total of 13.8 lb per person for these three primary big game species. The statewide estimates for 2015–2017 based on data provided above for reported harvests only are 5.3 lb for moose, 1.5 lb for caribou, and 1.9 lb for deer. Titus et al. (2009:4) reported that 75% of the caribou harvest in Alaska is from the Western Arctic and Teshekpuk herds, for which harvest reporting was not required until recently. If harvests of these herds are removed

Figure 7.–Percentage of annual Alaska salmon harvest by harvest category, annual average, 1994–2017

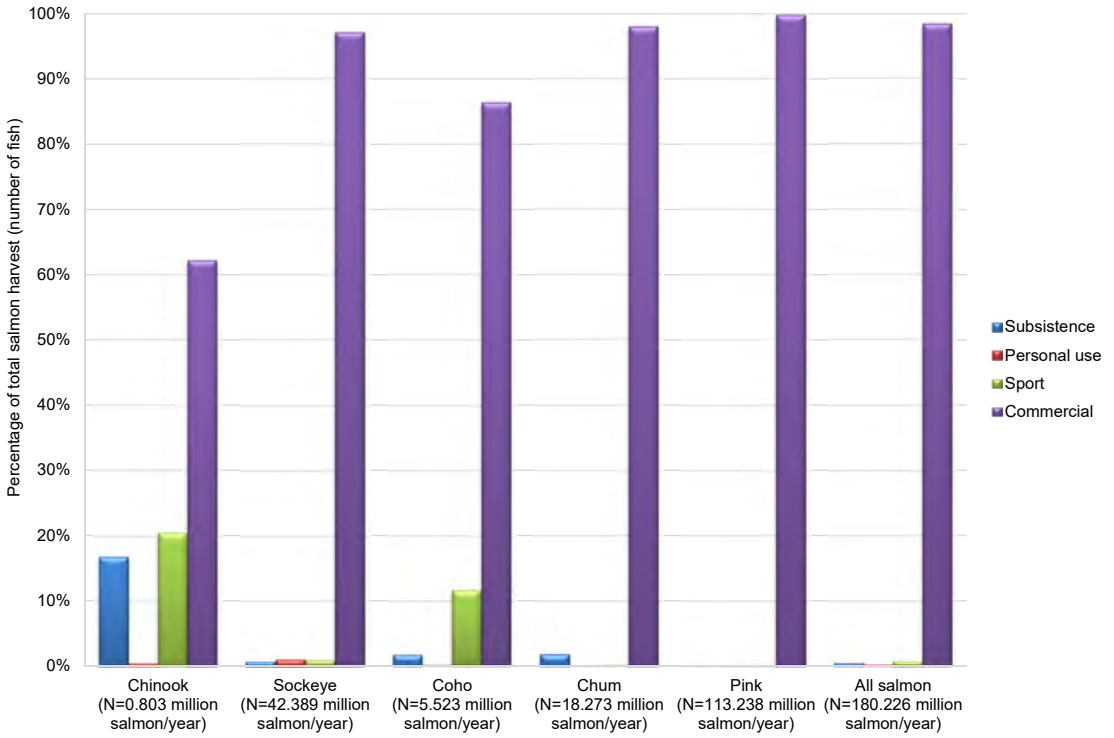


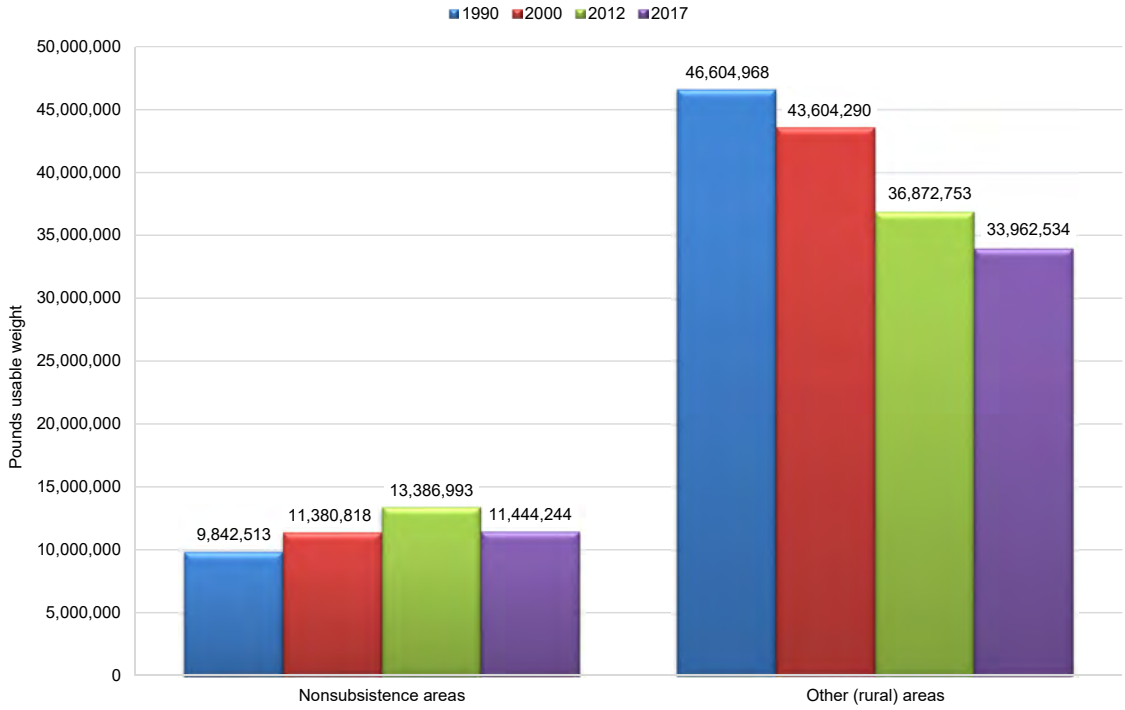
Plate 3.–Subsistence harvest of Arctic grayling, Nikolai, Alaska. Fish other than salmon (resident species and marine species) are a significant portion of rural Alaska's harvest of wild foods. Photo by James Van Lanen, ADF&G.

from the total estimated in Titus et al. (2009), the harvest of caribou would be 6,750 animals (25% of 27,000), or 1.7 lb/person.

A study of "The Value of Alaska Moose" (Northern Economics, Inc. 2006) estimated that the average annual reported harvest of moose for the five-year period 2000–2004 was 6,890 animals, for an estimated 3,789,500 lb of meat with a replacement value (at $4/lb) at about $15,158,000. Hasbrouck (2018; as summarized in Rozelle 2018) reported findings that the Alaska harvest of 7,200 moose in 2018 produced 3.5 million pounds of food. This is a per capita harvest for the state of about 4.8 lb (assuming all taken by state residents).

As shown in Figure 8, while substantial, estimated total wild resource harvests for rural Alaska have de-

Figure 8.–Estimated total harvests of noncommerical fish and wildlife harvests in Alaska, nonsubsistence areas and other (rural) areas, 1990, 2000, 2012, and 2017



clined since 1990, from about 46.6 million lb in 1990 to 34.0 million lb in 2017 (Fall 2016:57–59). Per capita harvests dropped from 397 lb in 1990, to 356 lb in 2000, 295 lb in 2012, and 276 lb in 2017 (Fall 2016:57; 2018). A combination of demographic, economic, sociocultural, regulatory, and environmental factors accounts for lower harvests over the last four decades (Wolfe and Walker 1987; Fall 2016). Among other things, these include the effects of climate change on travel conditions and the distribution and abundance of wildlife populations; diminished resource populations (such as recent declines in Chinook salmon stocks and several caribou herds); cultural and demographic change; and rising costs of fuel and equipment.

Plate 4.–Processing a subsistence harvest of moose, interior Alaska near Chalkyitsik, Alaska, 2009. Moose are the largest component of Alaska's harvest of land mammals. Photo by James Van Lanen, ADF&G.

Estimated total wild resource harvests of residents of Alaska's nonsubsis-

Plate 5.–Smoking and drying of subsistence salmon harvest, Nikolai, Upper Kuskokwim area, Alaska, 2009. Of all wild foods, salmon contribute the most to the noncommercial harvest in Alaska. Photo by James Van Lanen, ADF&G.

tence areas increased from about 9.8 million lb in 1990 to 11.4 million lb in 2000 and 13.4 million lb in 2012, largely due to population growth in these urban areas. As estimated in pounds usable weight per person, harvests remained steady over this period: 22.8 lb per person in 1990, 22.6 lb in 2000, and 22.0 lb in 2012 (Fall 2016:58). Estimated total harvests and per capita harvests for nonsubsistence areas were lower in 2017 than previous estimates: 11.4 million lb and 18.6 lb, respectively (ADF&G 2019). A drop in harvests of salmon in the Cook Inlet personal use fisheries likely accounts for much of this change.

5. Summary: Key Points

- Harvests of fish and wildlife are an important component of Alaska's food supply. We estimate that the wild food harvest in Alaska totaled about 45 million pounds in the mid-2010s, including 34 million pounds in rural areas and over 11 million pounds in urban areas. As part of Alaska's "hidden economy," this food production is rarely acknowledged in indices of economic growth, social welfare, or development policies.
- At about $5 to $10 per pound, the monetary cost to replace this food is $227–$454 million.
- The role of noncommercial wild resources varies within Alaska. Harvests are greatest in less populous, more remote rural areas, where wild food production averaged about 276 lb/person in the mid-2010s. In urban areas ("nonsubsistence areas" as classified by the state's regulatory system), wild food harvests averaged 18.6 lb/person.
- Wild food harvests provided about 176% of protein requirements and 25% of caloric requirements for all of Alaska's rural areas combined. For Alaska's urban population, the wild food harvest provided 12% of protein needs and 2% of caloric needs.

- Wild food harvests in Alaska are diverse. Salmon and other fish rank first in all areas except the Arctic, where marine mammals are the largest component of harvests. Fish are taken mostly in subsistence fisheries in rural areas, and in sport and personal use fisheries by urban residents. Moose, caribou, and deer make up most of Alaska's wildlife harvest.
- In addition to their economic and nutritional importance, fishing and hunting in Alaska support key social and cultural values, such as sharing, passing on skills and knowledge across generations, and respect for the fish and wildlife upon which diverse ways of life depend.
- While still substantial, available data suggest that harvests of wild foods in Alaska have declined since the 1980s and 1990s. Threats to the sustainability of wild food harvests include environmental, cultural, and demographic change; diminished fish and wildlife populations; and rising costs of fuel and equipment.

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