Species Management Report and Plan ADF&G/DWC/SMR&P–2021–28

Brown Bear Management Report and Plan, Game Management Units 12 and 20E:

Report Period 1 July 2014–30 June 2019, and

Plan Period 1 July 2019–30 June 2024

Jeffrey J. Wells

2021

Alaska Department of Fish and Game Division of Wildlife Conservation

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Hunters are important founders of the modern wildlife conservation movement. They, along with trappers and sport shooters, provided funding for this publication through payment of federal taxes on firearms, ammunition, and archery equipment, and through state hunting license and tag fees. These taxes and fees fund the federal Wildlife Restoration Program and the State of Alaska's Fish and Game Fund, which provided funding for the work reported on in this publication.

Species management reports and plans provide information about species that are hunted or trapped and management actions, goals, recommendations for those species, and plans for data collection. Detailed information is prepared for each species every 5 years by the area management biologist for game management units in their areas, who also develops a plan for data collection and species management for the next 5 years. This type of report is not produced for species that are not managed for hunting or trapping or for areas where there is no current or anticipated activity. Unit reports are reviewed and approved for publication by regional management coordinators and are available to the public via the Alaska Department of Fish and Game's public website.

This species management report and plan was reviewed and approved for publication by Ryan Klimstra, Acting Management Coordinator for the Division of Wildlife Conservation.

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This document, published in PDF format only, should be cited as:

Wells, J. J. 2021. Brown bear management report and plan, Game Management Units 12 and 20E: Report period 1 July 2014–30 June 2019, and plan period 1 July 2019–30 June 2024. Alaska Department of Fish and Game, Species Management Report and Plan ADF&G/DWC/SMR&P-2021-28, Juneau.

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Purpose of this Report

This report provides a record of survey and inventory management activities for brown bear in Units 12 and 20E for the 5 regulatory years 2014–2018 and plans for survey and inventory management activities in the following 5 regulatory years, 2019–2023. A regulatory year (RY) begins 1 July and ends 30 June (e.g., RY14 = 1 July 2014–30 June 2015). This report is produced primarily to provide agency staff with data and analysis to help guide and record agency efforts but is also provided to the public to inform it of wildlife management activities. In 2016 the Alaska Department of Fish and Game's (ADF&G, the department) Division of Wildlife Conservation (DWC) launched this 5-year report to more efficiently report on trends and to describe potential changes in data collection activities over the next 5 years. It replaces the brown bear management report of survey and inventory activities that was previously produced every 3 years.

I. RY14–RY18 Management Report

Management Area

Unit 12 is in east-central Alaska bounded by the Canada border on the east and is centered on 62°34′N latitude and 142°7′W longitude. Major drainages within the unit include the Nabesna and Chisana drainages, which combine to form the Tanana River, and the White River drainage. Unit 12 encompasses 9,975 mi^2, of which approximately 8,070 mi^2, or that portion below 6,000 feet in elevation, is likely generally suitable brown bear habitat (Reynolds 1997, Eagan 1995). Elevations within the unit range from 1,500 feet along the Tanana River to >12,000 feet in the Wrangell, Nutzotin, and Mentasta mountains.

Unit 20E is in east-central Alaska directly north of Unit 12, is bounded by the Canada border on the east, and is centered on 64°16′N latitude, 142°20′W longitude. Major drainages within the unit include the Fortymile, Charley, Ladue, and Seventymile river drainages. Unit 20E encompasses 10,680 mi^2, all of which is generally suitable brown bear habitat. The unit was described in detail by Gasaway et al. (1992) and generally consists of hills with elevations ranging from 1,000 feet to 5,000 feet. However, more mountainous areas, with elevations exceeding 6,000 feet, are found in the northwestern portion of the unit, and lowland areas (2,000–2,500 feet; Mosquito Flats) are found in the southwestern portion of the unit.

Vegetation types within both units vary and include lowland shrub and sedge meadows, mature black spruce (*Picea mariana*) and white spruce (*Picea glauca*) forest, recently burned areas dominated by shrubs and early successional forest species, deciduous forest, subalpine shrub, and alpine tundra. The climate is typical of Interior Alaska, where temperatures frequently reach 80°F in summer and −40°F in winter.

Summary of Status, Trend, Management Activities, and History of Brown Bears in Units 12 and 20E

Brown bears are distributed throughout much of Units 12 and 20E, although specific population density and composition data are limited. No population surveys have been conducted to date in Unit 12, while 2 population surveys using different techniques have been conducted in southern

Unit 20E. During the mid-1980s, Boertje et al. (1987) used the direct count method in addition to harvest and radiocollar data to estimate the brown bear population in a 4,000 km^2 portion of southern Unit 20E at 16 bears of all ages/1,000 km^2 in May, and 12 bears of all ages/1,000 km^2 in November. During May–July 2006, a DNA-based mark-recapture survey was conducted within a 5,193 km^2 area in southern Unit 20E which resulted in an estimated 10.7–13.4 brown bears of all ages/1000 km^2 (C. Gardner, K. Kellie, and J. Citta, Wildlife Biologists, ADF&G, unpublished memorandum 12 March 2008, Fairbanks). Although no population surveys have been conducted in Unit 12, Gardner (2003) estimated the fall 2000 Unit 12 brown bear population at 350–425 bears (18.0–21.9 bears of all ages/1,000 km^2 of useable habitat) based upon 1) extrapolations from density estimate surveys conducted in similar habitats in Interior and Southcentral Alaska, 2) harvest distribution, and 3) sex and age composition of harvested bears.

Brown bear management in Units 12 and 20E during recent decades has been driven primarily by 1) the goal to reduce brown bear predation on moose calves, and 2) the goal to provide for maximum sustainable hunting opportunity. During the late 1970s and early 1980s, predation by brown bears was identified as a major factor in maintaining the moose population in Unit 20E (Gasaway et al. 1992) and nearby Unit 13 (Ballard et al. 1991) at low densities. In response, brown bear management objectives were altered in both Units 12 and 20E to include the objective of temporarily reducing brown bear populations to elevate moose calf survival and ultimately moose abundance. Brown bear hunting regulations were liberalized in both units beginning in the early 1980s with the goal of increasing brown bear harvest. Regulation changes included lengthening the brown bear season, increasing the bag limit from 1 bear/4 years to 1 bear/year, and waiving the $25 resident brown bear tag fee. Brown bear harvest initially increased in both units following the liberalizations, although it was unclear whether the increased harvest resulted in an increase in moose calf survival (Gardner 1995a, Gardner 1995b).

The Unit 12 brown bear management objective to reduce the brown bear population to increase moose calf survival was removed in 1994, while the more general management goal to provide for maximum sustained hunting opportunity was retained (Gardner 1998). The same management goal remained in Unit 20E; however, the objective to temporarily reduce brown bear populations or brown bear predation on moose was also retained. Additional efforts to temporarily reduce the Unit 20E brown bear population included an increase in the resident bag limit to 2 bears per year in RY05, and a brown bear predation control program during RY05–RY08 in which Alaska residents were issued predation control permits to take bears within a 2,741 mi^2 control area (expanded to 4,046 mi^2 in RY06) in southern Unit 20E. Within the predator control area, individuals were allowed to take an unlimited number of brown bears, harvest brown bears over bait, and sell untanned brown bear hides. However, the control program was suspended in July 2009 because hunter harvest and kill by predation control permittees remained low (Bentzen 2011). Unit 20E brown bear harvest since RY09 likely remained below levels that would be effective at reducing brown bear numbers enough to reduce their predation on moose calves (Wells 2015). Brown bear hunting opportunity was expanded in RY12 in both Units 12 and 20E by allowing the harvest of brown bears at black bear bait stations during open black bear baiting seasons at permitted black bear baiting stations. Brown bear harvest initially appeared to remain stable following this change, although a higher proportion of the harvest shifted to the spring (Wells 2015).

Management Direction

Existing Wildlife Management Plans

Direction in the Interior-Western Alaska brown bear management plan (ADF&G 1976) has been reviewed and modified through public comments, staff recommendations, and Board of Game actions over the years. A record of these changes can be found in the division's management report series. The plan portion of this report contains the current management plan for brown bear in Units 12 and 20E.

Goals

During RY14–RY18, the Units 12 and 20E brown bear management goals were as follows:

Unit 12:

G1. Maintain the brown bear population and its habitat in concert with other components of the ecosystem.

G2. Provide the greatest sustained opportunity to hunt brown bears in Unit 12.

Unit 20E:

G1. Provide maximum opportunity to hunt brown bears in Unit 20E.

Codified Objectives

Amounts Reasonably Necessary for Subsistence Uses

Brown bears in Units 12 and 20E have a negative customary and traditional use finding, as determined by the Board of Game.

Intensive Management

Not applicable.

Management Objectives

During RY14–RY18, the Units 12 and 20E brown bear management objectives were as follows:

Unit 12:

M1. Manage harvests so 3-year mean harvest does not exceed 28 brown bears (of which no more than 5 can be females greater than 5-years old) per year and includes at least 55% males in the harvest.

Unit 20E:

M1. Manage for temporary reductions in the brown bear population or for reduction in brown bear predation where it may be limiting moose population growth (e.g., when moose populations are below food-limiting densities and autumn calf-to-cow ratios are <25:100).

M2. After moose populations increase to desired levels, reduce bear harvests to allow for bear population stabilization or recovery.

MANAGEMENT ACTIVITIES

1. Population Status and Trend

Activities to assess the Units 12 and 20E brown bear population status and trend were not conducted during RY14–RY18. Although information on population status and trend would be useful when evaluating the Unit 12 and 20E management goals and objectives, current options for measuring these parameters are unfeasible in these units given resource constraints (e.g., budget and personnel) and other regional management priorities that took higher precedence during this reporting period.

2. Mortality-Harvest Monitoring and Regulations

ACTIVITY 2.1. Monitor and analyze harvest data

Data Needs

Harvest data are necessary to evaluate management objectives.

Methods

All brown bears taken in Units 12 and 20E must be sealed by an authorized department representative (sealer) within 30 days of the kill. Data collected during the sealing process included skull measurements, sex, harvest date, specific harvest location, transport methods, harvest method (e.g., taken over bait), and time the hunter spent afield. In addition, a vestigial premolar tooth was collected, when possible, and sent to Matson's Laboratory (Milltown, Montana) to determine age.

Season and Bag Limit

During RY14–RY18, the season dates for brown bears in Units 12 and 20E were 10 August–30 June, and the bag limit was 1 bear per year in Unit 12 and 2 bears per year in Unit 20E. Harvest of cubs (in the first 2 years of life) or females accompanied by cubs was prohibited. Bears could be taken over bait at bear bait stations during 15 April 15–30 June, and hunters were required to register all bear bait stations with ADF&G. The minimum salvage requirements included the hide and skull, while the meat was also required to be salvaged for brown bears taken over bait during RY14–RY15.

Results and Discussion

Harvest by Hunters-Trappers

Annual brown bear harvest by hunters during RY14–RY18 averaged 21 and 18 bears per year in Units 12 and 20E, respectively (Tables 1 and 2). This is similar to the previous 5-year average brown bear harvest of 23 and 16 bears per year in Units 12 and 20E, respectively. Unit 20E harvest in RY17 was 25 bears, which is the highest annual reported harvest in the last 30 years. Three-year running average annual brown bear harvest in Unit 12 ranged from 19–24 during RY14–RY18, which met the management objective for the 3-year average harvest to not exceed 28 bears per year. Annual harvest has fluctuated but overall has remained stable since RY83 in both Units 12 and 20E (Figs. 1 and 2), despite numerous liberalizations in both units during that period.

Conversely, the Unit 20E management objective to temporarily reduce the brown bear population within portions of the unit was likely not achieved, although no surveys were conducted to specifically address this question. The average annual harvest of 18 bears during RY14–RY18 likely represented an approximate unitwide harvest rate of 5–6%, assuming unitwide densities of 10.7–13.4 bears/1000 km^2. Localized harvest rates were likely higher, though, especially within the southern portion of the unit. Average annual harvest during RY14–RY18 within the Mosquito and Dennison Forks of the Fortymile River drainage was 9.6 bears/year. This represents approximately 50% of the unitwide annual average harvest, although the total unitwide area represented by these drainages is only 25%. Assuming a density of 10.7–13.4 bears/1000 km^2 within these drainages, the harvest of 9.6 bears per year represents an approximate harvest rate of 10–13%. Sustainable brown bear harvest rate estimates vary, but it's likely that a harvest rate >8–10% is necessary to cause a reduction in a brown bear population (Boertje et al. 1987, Reynolds and Boudreau 1992, McLellan et al. 2016, Brockman et al. 2020). Brockman et al. (2020) documented an annual average decrease of the brown bear population within a portion of Unit 13 of 2% per year for all bears and 4% per year for independent bears (bears not associated with their mother) with a minimum average annual estimated harvest rate of 8.4% during RY95–RY10. Therefore, the estimated Unit 20E harvest rate of 5–6% during RY14–RY18 likely did not influence population trend, while it's possible that the higher estimated harvest rate of 10–13% within southern Unit 20E could have impacted the population trend within this area. However, given that the area of higher harvest is surrounded by areas that are lightly harvested, the potential impact of the harvest on this portion of the population is difficult to ascertain. Consequently, the level of reduction in the brown bear population necessary to achieve a measurable and meaningful impact on the moose population was likely not achieved. Although bear reductions of >60% of the population have been shown to increase moose calf and/or adult survival rates (Ballard and Miller 1990, Keech et al. 2011), impacts to moose populations via brown bear harvest from hunters alone has yet to be documented.

Table 1. Unit 12 reported brown bear harvest, Interior Alaska, regulatory years 2014–2018.

Regulatory year	Hunter kill						Hunter residency				Nonhunting kill[a]		
	M	(%)	F	Unk	Total	Baited (%)	Resident	(%)	Nonresident	(%)	M	F	Unk
2014													
Fall 2014	6	(60)	4	0	10	–	5	(50)	5	(50)	0	0	0
Spring 2015	10	(77)	3	0	13	8 (62)	9	(69)	4	(31)	0	0	0
Total	16	(70)	7	0	23	8 (35)	14	(61)	9	(39)	0	0	0
2015													
Fall 2015	12	(60)	8	0	20	–	10	(50)	10	(50)	0	0	0
Spring 2016	2	(33)	4	0	6	4 (67)	5	(83)	1	(17)	0	0	0
Total	14	(54)	12	0	26	4 (15)	15	(58)	11	42	0	0	0
2016													
Fall 2016	4	(50)	4	0	8	–	6	(75)	2	(25)	0	0	0
Spring 2017	6	(75)	2	0	8	5 (63)	5	(63)	3	(37)	0	0	0
Total	10	(63)	6	0	16	5 (31)	11	(69)	5	(31)	0	0	0
2017													
Fall 2017	4	(40)	6	0	10	–	8	(80)	2	(20)	0	0	0
Spring 2018	10	(71)	4	0	14	11 (79)	11	(79)	3	(21)	0	0	0
Total	14	(58)	10	0	24	11 (46)	19	(79)	5	(21)	0	0	0
2018													
Fall 2018	5	(56)	4	0	9	–	6	(67)	3	(33)	1	0	0
Spring 2019	4	(50)	4	0	8	7 (88)	8	(100)	0	(0)	0	0	0
Total	9	(53)	8	0	17	7 (41)	14	(82)	3	(18)	1	0	0
2014-2018 combined													
Fall	31	(54)	26	0	57	–	35	(61)	22	(39)	1	0	0
Spring	32	(65)	17	0	49	35 (71)	38	(78)	11	(22)	0	0	0
Total	63	(59)	43	0	106	35 (33)	73	(69)	33	(31)	1	0	0

Note: En dash indicates no data as there was not a fall bear baiting season for Unit 12.

[a] Includes defense of life or property kills, research mortalities, and other known human-caused accidental mortality.

Table 2. Unit 20E reported brown bear harvest, Interior Alaska, regulatory years 2014–2018.

Regulatory year	Hunter kill						Hunter residency				Nonhunting kill[a]		
	M	(%)	F	Unk	Total	Baited (%)	Resident	(%)	Nonresident	(%)	M	F	Unk
2014													
Fall 2014	7	(47)	8	0	15	–	14	(93)	1	(7)	0	0	0
Spring 2015	1	(33)	2	0	3	3 (100)	3	(100)	0	(0)	1	0	0
Total	8	(44)	10	0	18	3 (16)	17	(94)	1	(6)	1	0	0
2015													
Fall 2015	7	(47)	8	0	15	–	15	(100)	0	(0)	0	0	0
Spring 2016	1	(50)	1	0	2	2 (100)	2	(100)	0	(0)	0	0	0
Total	8	(47)	9	0	17	2 (12)	17	(100)	0	(0)	0	0	0
2016													
Fall 2016	4	(40)	6	0	10	–	8	(80)	2	(20)	0	1	0
Spring 2017	2	(33)	4	0	6	2 (33)	6	(100)	0	(0)	0	0	0
Total	6	(38)	10	0	16	2 (13)	14	(88)	2	(12)	0	1	0
2017													
Fall 2017	14	(64)	8	0	22	–	20	(91)	2	(9)	0	0	0
Spring 2018	1	(33)	2	0	3	2 (66)	3	(100)	0	(0)	0	0	0
Total	15	(60)	10	0	25	2 (8)	23	(92)	2	(8)	0	0	0
2018													
Fall 2018	2	(20)	8	0	10	–	10	(100)	0	(0)	0	0	0
Spring 2019	2	(66)	1	0	3	2 (66)	3	(100)	0	(0)	0	0	0
Total	4	(31)	9	0	13	2 (15)	13	(100)	0	(0)	0	0	0
2014–2018 combined													
Fall	34	(47)	38	0	72	–	67	(93)	5	(7)	0	1	0
Spring	7	(41)	10	0	17	11 (65)	17	(100)	0	(0)	1	0	0
Total	41	(46)	48	0	89	11 (12)	84	(94)	5	(6)	1	1	0

Note: En dash indicates no data as there was not a fall bear baiting season for Unit 20E.

[a] Includes defense of life or property kills, research mortalities, and other known human-caused accidental mortality.

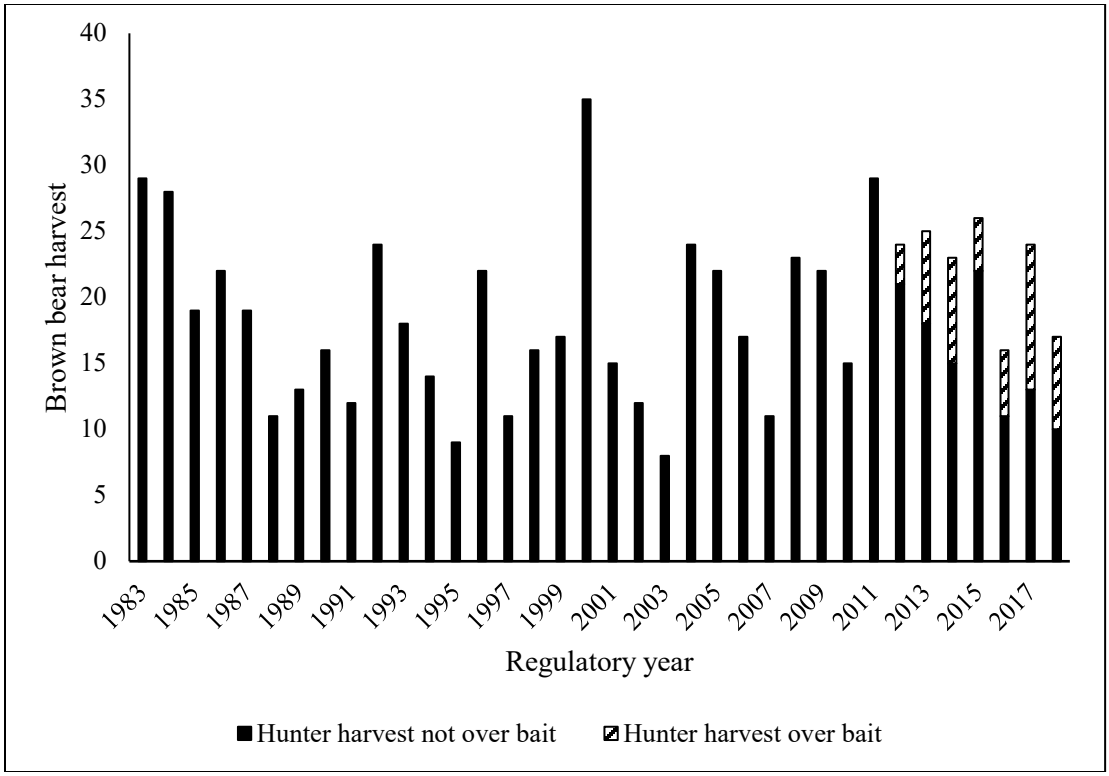


Figure 1. Unit 12 reported brown bear harvest by harvest method, Interior Alaska, regulatory years 1983–2018.

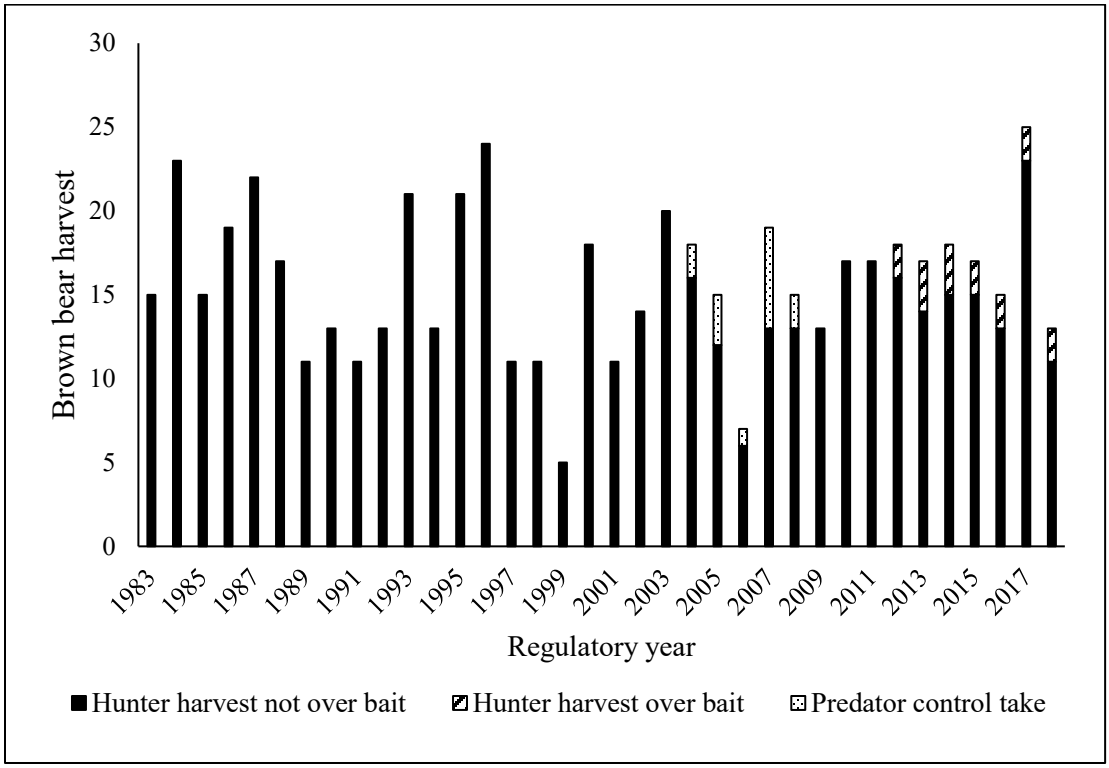


Figure 2. Unit 20E reported brown bear harvest by harvest method, Interior Alaska, regulatory years 1983–2018.

Males composed 59% and 46% of the RY14–RY18 harvest in Units 12 and 20E, respectively (Tables 1 and 2). The 3-year running male proportion of the Unit 12 harvest during RY14–RY18 ranged from 58–65%, which met the management objective for at least 55% males in the harvest. The proportion of males in the Unit 20E harvest was much lower compared to RY04–RY08 and RY09–RY13, when males composed 65% and 56% of the harvest, respectively.

During RY14–RY18, age data was available for 79 (35 female and 44 males; 75% of overall harvest) and 72 (42 females and 30 males; 81% of overall harvest) brown bears harvested in Units 12 and 20E, respectively. Although teeth were marked on the sealing form as being collected from an additional 12 and 3 brown bears harvested in Units 12 and 20E, respectively, no age data was available for these animals. The average age of hunter-killed females was 5.7- (median = 5) and 7.1-years old (median = 5.5) in Unit 12 and 20E, respectively. The 3-year running average number of females >5-years old in the Unit 12 harvest ranged from 1–3 during RY14–RY18, which met the management objective of no more than 5 females >5-years old in the 3-year running average harvest. For males, the average age was 6.9- (median = 6) and 6.7-years old (median = 5) for Units 12 and 20E, respectively. Except for females harvested in Unit 12, the average age of bears harvested during RY14–RY18 was higher than during RY09–RY13. The average age of hunter-killed females during RY09–RY13 was 6.5 and 5.8 years old for Units 12 and 20E, respectively. For males, the average age was 5.9- and 4.8-years old for Units 12 and 20E, respectively.

The average skull size from harvested brown bears in both Units 12 and 20E during RY14–RY18 was similar to prior reporting periods. The average skull size for males was 21.4 and 21.7 inches in Units 12 and 20E, respectively, and for females it was 19.5 and 19.4 inches, respectively. This compares to the RY09–RY13 average skull sizes of 20.7 and 20.5 inches for males in Units 12 and 20E, respectively, and 18.9 and 19.1 inches for females, respectively.

The Alaska Board of Game passed a proposal in March 2012 that allowed for the harvest of brown bears at bear bait stations in Units 12 and 20E beginning in RY12. During RY14–RY18, a higher proportion of the Unit 12 brown bear harvest was taken over bait compared to Unit 20E, although in both units the majority of the spring harvest was taken over bait. In Unit 12, an average of 7 bears were harvested over bait per year during RY14–RY18, and this harvest averaged 71% and 33% of the total spring and annual harvest, respectively. In Unit 20E, an average of 2 bears were harvested over bait per year, and this harvest averaged 65% and 12% of the total spring and annual harvest, respectively.

Hunter Residency and Success

Similar to prior reporting periods, the majority of brown bears harvested during RY14–RY18 in Units 12 and 20E were taken by residents, while the proportion taken by nonresidents was higher in Unit 12 than in Unit 20E (Tables 1 and 2).

Harvest Chronology

The proportion of brown bears harvested in spring increased in Unit 12 compared to prior reporting reports but remained similar in Unit 20E. The proportion of brown bears taken during spring in Unit 12 during RY14–RY18 was 46% (Table 1) compared to 31% and 11% during RY09–RY13 and RY04–RY08, respectively. This increase coincided with the allowance to take brown bears over bait in Unit 12 beginning in RY12. On the other hand, even though brown

bears were also allowed to be taken over bait in Unit 20E beginning in RY12, the proportion of brown bears taken during the spring in Unit 20E has remained low. Spring brown bear harvest in Unit 20E composed 19% of the overall harvest during RY14–RY18 (Table 2) compared to 22% and 30% during RY09–RY13 and RY04–RY08, respectively.

Transport Methods

In general, transportation use by successful brown bear hunters in both Units 12 and 20E was similar to prior reporting periods. However, the proportion of successful hunters using 4 wheelers increased compared to RY09–RY13 from 21% to 35% in Unit 12 and from 24% to 47% in Unit 20E. The other most common modes of transportation included airplane (20% in Unit 12, 30% in Unit 20E), dog team/horses (19% in Unit 12, 0% in Unit 20E), and highway vehicle/foot (16% in Unit 12, 13% in Unit 20E).

Other Mortality

Defense of life and property (DLP) brown bear kills continue to occur at low levels in Units 12 and 20E. This is likely in part due to the liberal hunting season and bag limit, which often allows people the opportunity to harvest problem bears (except for cubs or sows with cubs) without the necessity to go through the DLP process. A total of 3 brown bears were killed for DLP purposes during RY14–RY18 (Tables 1 and 2). This is similar to RY09–RY13, when 2 brown bears were killed for DLP (both in Unit 12).

Alaska Board of Game Actions and Emergency Orders

The Alaska Board of Game approved a proposal to allow the sale of brown bear hides with claws attached and/or skulls of brown bears taken in areas with a 2 brown bear bag limit per regulatory year at their March 2016 meeting. This regulation went into effect in RY16 and applied to brown bears taken in Unit 20E given the 2 brown bear bag limit per regulatory year in this unit.

Recommendations for Activity 2.1

Continue.

3. Habitat Assessment-Enhancement

ACTIVITY 3.1. Habitat assessment

Data Needs

Units 12 and 20E brown bear harvest varies annually, and food abundance may influence harvest, including composition of the harvest. Although few studies have looked at brown bear harvest metrics in relation to food abundance, black bear harvest success rates, overall harvest, and/or composition has been found to vary with natural food abundance in areas outside of Alaska including Ontario (Obbard et al. 2014), Minnesota (Noyce and Garshelis 1997), and West Virginia (Ryan et al. 2004). Although brown bear diet composition varies seasonally and geographically depending on a variety of factors, berries have been shown to be an important component of the brown bear diet in fall, although the preferred berry type varies depending on a variety of factors, including availability (Hetchel 1985, Gau 1998, McLellan and Havey 1995). Although no diet studies have been conducted specifically on brown bears in Interior Alaska, it is likely that blueberries are the most important berry for brown bears in this area given the general

widespread nature and abundance of the plant. Further, Hatler (1972) studied the food habits of black bears in Interior Alaska during 1964–1965 and concluded that although other fruits such as rose hips, highbush cranberries, and crowberries are occasionally important, blueberries are the most important fall food source to black bears in Interior Alaska.

During falls of poor berry production, bears may travel more in search of berries and/or may be more attracted to other food sources such as hunter-killed moose or caribou, or other human foods, and this increased travel could result in more vulnerability of bears to hunters. In addition, it's plausible that fall berry production could influence spring harvest. For example, if bears were to enter the den in a lower body condition during years of poor berry production and emerge from the den in a lower body condition, than they might be more vulnerable to human harvest for the same reasons as in the fall (e.g., increased travel to search for natural foods or a higher affinity to other food sources such as bait stations). Furthermore, past studies have shown that the female black bear proportion of harvest was inversely related to food abundance, likely because females have smaller home ranges than males and must therefore proportionally increase their home range to a larger degree than males to search for food during years of poor abundance, and this increase in their home range size increased their vulnerability to harvest (Noyce and Garshelis 1997, Ryan et al. 2004, Obbard et al. 2014). Given that this relative difference between female and male home range sizes has also been shown in brown bears (Dahle and Swenson 2003, Brockman 2015), this inverse relationship between food abundance and proportion of females in the harvest could also apply to brown bears. Therefore, blueberry abundance in Units 12 and 20E could influence both total harvest (fall and spring) and harvest composition, which relates to the Units 12 and 20E brown bear management objectives. Blueberry abundance could therefore be used to help explain changes in both total harvest and harvest composition. The specific hypotheses were that fall, spring, and total brown bear harvest, the proportion of females in the fall harvest, and the proportion of harvest that was reported as incidental would all be negatively correlated with blueberry abundance.

Methods

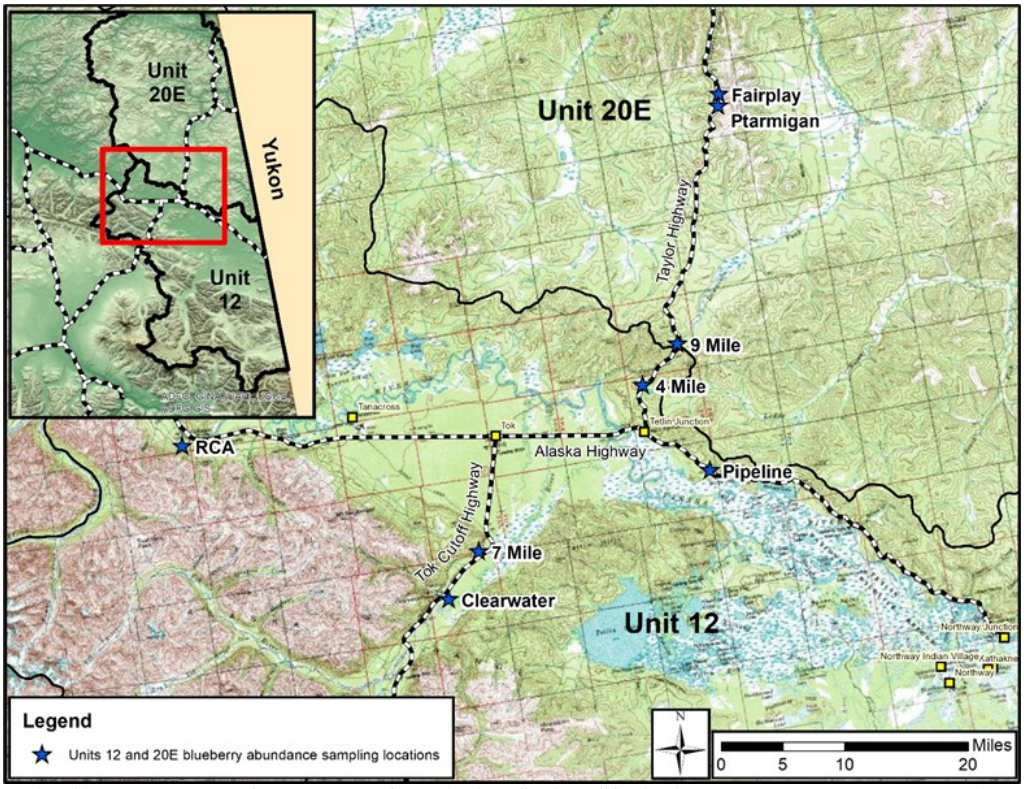
Eight permanent blueberry sampling areas were established in summer 2000, of which 5 were in Unit 12, and 3 in Unit 20E (Fig. 3). Each sampling area included 5, one-meter^2 plots distributed throughout the sampling area (Fig. 4). The sampling areas and individual plots were not selected randomly but were instead selected by both the presence of blueberry plants and to represent a variety of habitat types, aspects, elevations, and slopes. Each plot was marked with permanent wooden stakes and the total number of blueberries were counted in each plot during the end of July or early August. Blueberry abundance was assessed as the average number of blueberries counted per plot (or average number of blueberries/m^2) and was meant to be an index to blueberry abundance as opposed to an estimate of the number of blueberries/m^2 within Units 12 and 20E. The preliminary linear regression analysis was conducted using Microsoft Excel® software (Microsoft®, Redmond, Washington).

Results and Discussion

Blueberry abundance was assessed at plots during RY00–RY18 except for RY02, RY09, and RY13. The average number of blueberries per plot (1 m^2) ranged from 2.75–93.8 ($\bar{x}$ = 39.3; Fig. 5). Units 12 and 20E fall, spring, and combined (fall and the following spring) brown bear harvest ranged from 18–44 ($\bar{x}$ = 28), 1–17 ($\bar{x}$ = 9), and 23–53 ($\bar{x}$ = 36), respectively. The preliminary analysis suggests a negative correlation between fall harvest and total harvest with blueberry plot abundance; however, these correlations are not statistically significant

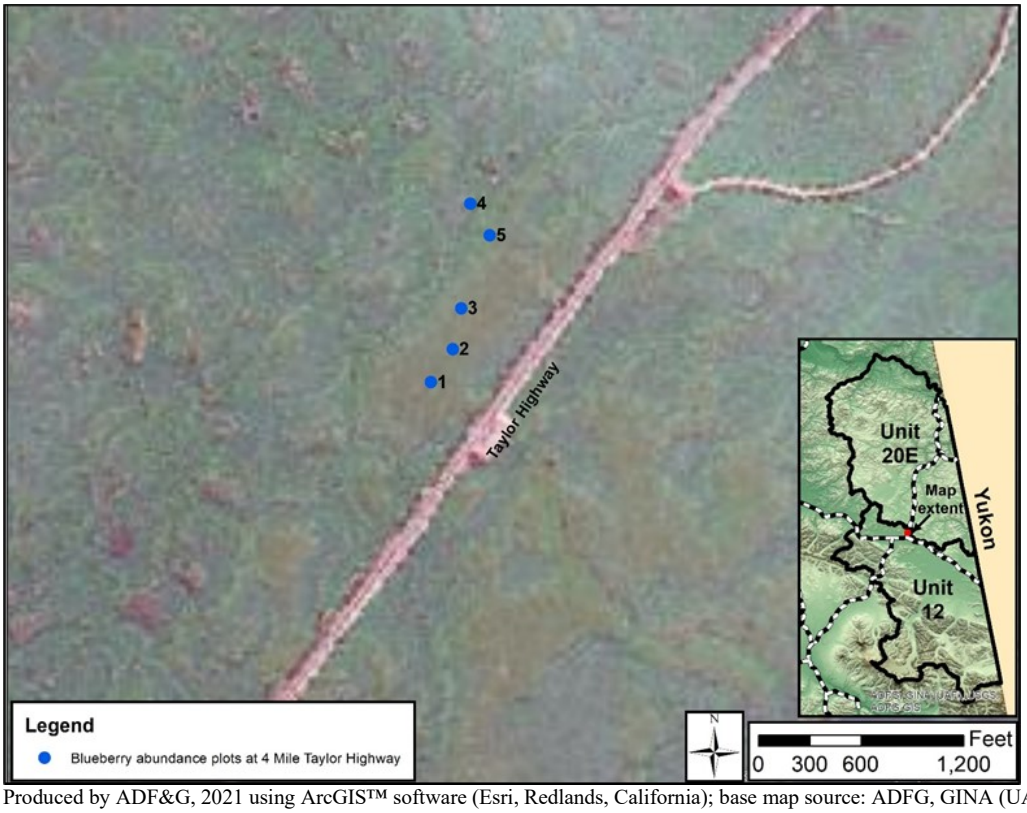
(*P*-value>0.05; Fig. 6). Further, neither the spring harvest, percent female harvest, nor percent incidental take was statistically correlated with blueberry plot abundance.

Preliminary results suggest that brown bear harvest in Units 12 and 20E was not correlated with blueberry abundance during RY00–RY18. Although seasonal and total brown bear harvest within these units varies annually, this variation does not appear to be correlated with blueberry abundance. Instead, other factors such as the availability of alternate food resources for the bears and/or the number of caribou and moose hunters in the fall that might also harvest a brown bear could influence harvest. Furthermore, there was no correlation between blueberry abundance and percent females in the harvest. One possible reason why harvest composition was not correlated to berry abundance is the restriction of taking sows accompanied by cubs within 2 years of life. Even if these sows with cubs/yearlings potentially became more vulnerable to hunters during years of poor berry production, they are not legal to be harvested. The percent incidental take was also not correlated with berry abundance. Reported incidental take is higher during the fall ($\bar{x}$ = 31%) than during the spring ($\bar{x}$ = 17%) and in both instances the variation in the proportion of incidental take appears unrelated to berry production. In summary, based upon the preliminary analysis, it appears that berry abundance does not correlate with brown bear harvest, the sex composition of the harvest, or the proportion of incidental take in Units 12 and 20E.



Produced by ADF&G, 2021 using ArcGIS™ software (Esri, Redlands, California); base map source: ADFG, GINA (UAF), USGS, ADFG GIS.

Figure 3. Blueberry abundance sampling areas in Units 12 and 20E, Interior Alaska.



Produced by ADF&G, 2021 using ArcGIS™ software (Esri, Redlands, California); base map source: ADFG, GINA (UAF), USGS, ADFG GIS.

Figure 4. Blueberry plot layout at the 4 Mile Taylor Highway blueberry abundance sampling area in Unit 12, Interior Alaska.

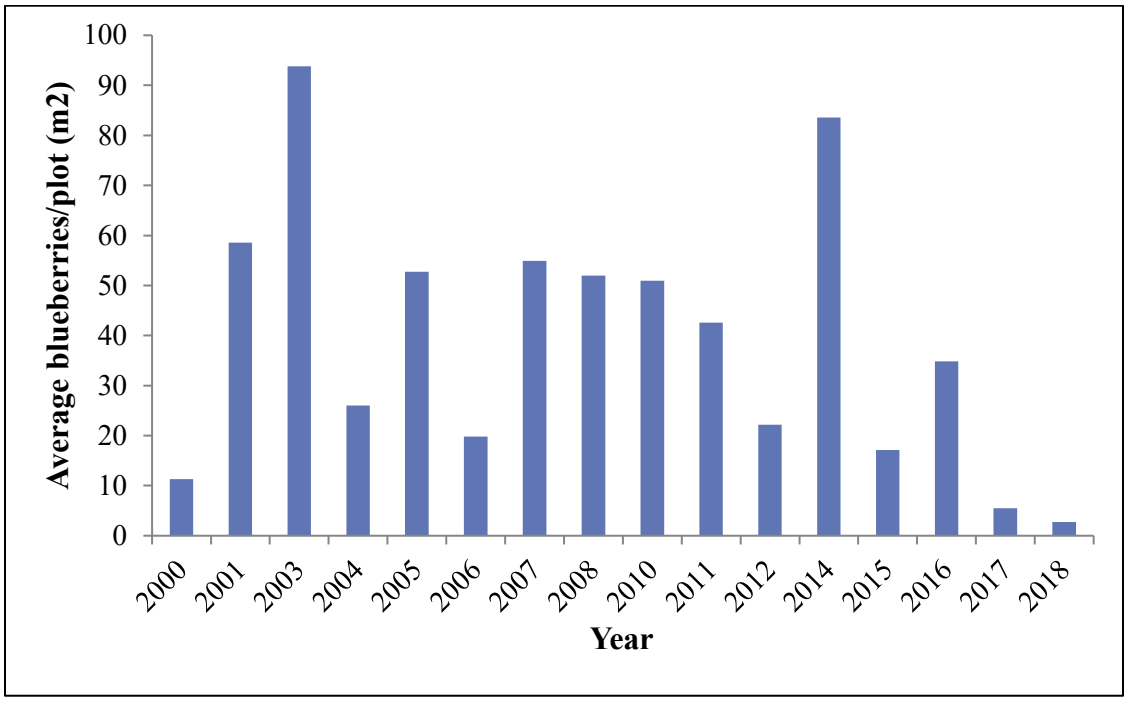
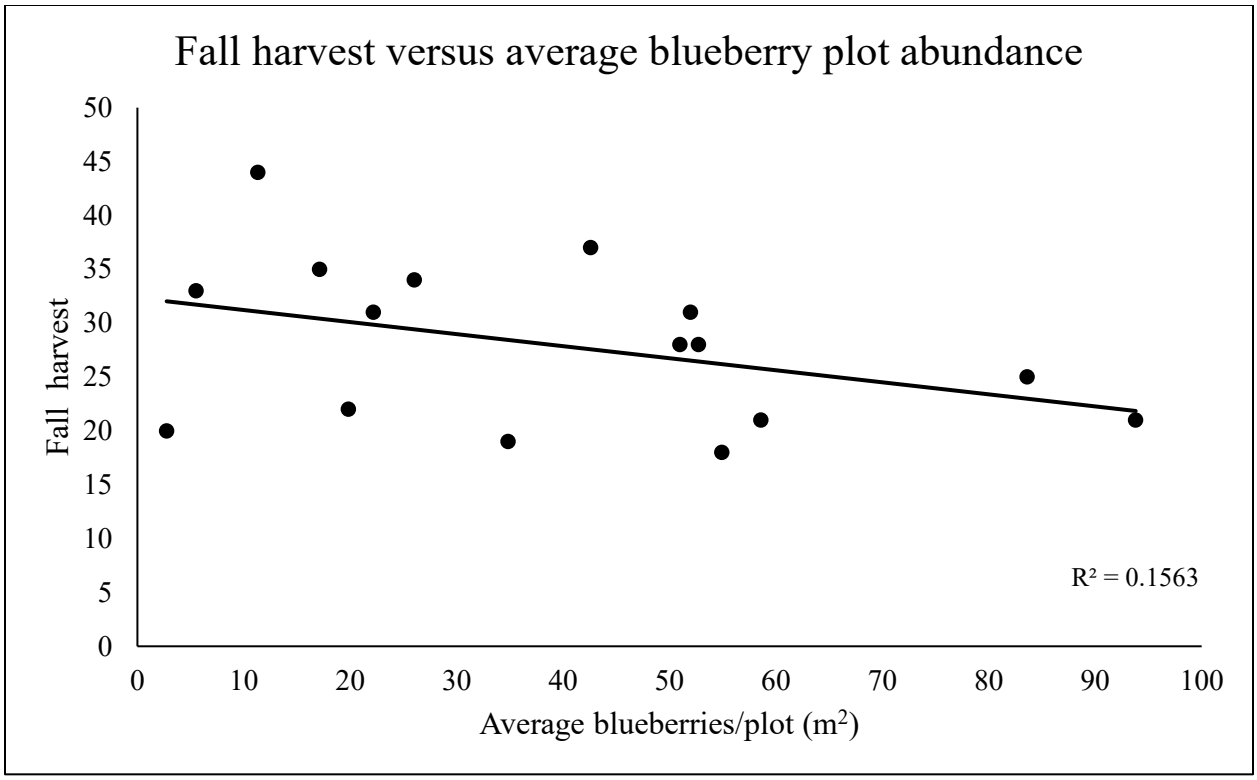


Figure 5. Average blueberry plot abundance (blueberries/meter^2) from blueberry sampling areas in Units 12 and 20E, Interior Alaska, 2000–2018 (no sampling occurred during 2002, 2009, or 2013).



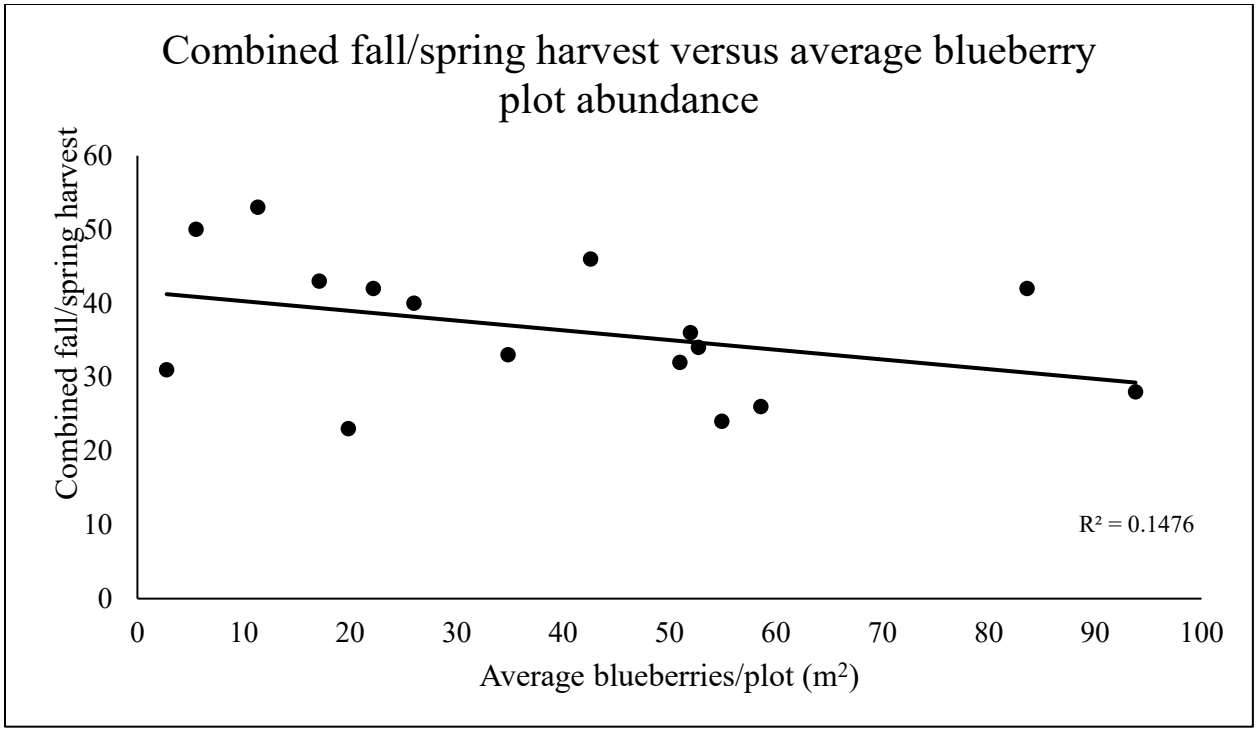


Figure 6. Fall and combined fall/spring brown bear harvest in Units 12 and 20E versus average blueberry plot abundance (blueberries/meter^2; line represents the fitted linear trend with associated R^2 value) from blueberry sampling areas in Units 12 and 20E, Interior Alaska, regulatory years 2000–2018.

Recommendations for Activity 3.1

Discontinue; this preliminary analysis suggests that blueberry abundance, as measured in this project, does not correlate with brown bear harvest. However, blueberry plot monitoring will continue in relation to black bear management within Units 12 and 20E. Therefore, this analysis could be completed again in the future after additional years of data collection.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

None.

Data Recording and Archiving

- All harvest and sealing data are stored on an internal database housed on ADF&G's Wildlife Information Network (WinfoNet) server (http://winfonet.alaska.gov/index.cfm).
- All other electronic files are located on the Tok server (S:\Wells\Grizzly bear and S:\Wells\Blueberries) with hard copy files stored in the filing cabinet in the Tok office conference room.

Agreements

None.

Permitting

None.

Conclusions and Management Recommendations

The Unit 12 brown bear management objective was achieved during RY14–RY18. The 3-year running average annual harvest did not exceed either 28 bears or 5 females >5-years old per year. This management objective is meant to represent the estimated maximum sustainable yield from the population, which in this case is 8% of the lower bound of the estimated population size range. However, there are several caveats associated with this objective. First, there have been no brown bear population surveys conducted in Unit 12; therefore, the population estimate used to calculate the objective is primarily based on population estimates from other similar areas within Interior Alaska. Second, estimates of sustainable brown bear harvest rates vary, but the available data suggests that harvest rates of ≤8% likely have a minimal impact on the population (Boertje et al. 1987, Reynolds and Boudreau 1992, McLellan et al. 2016, Brockman et al. 2020). However, given the unknowns associated with both the estimated population size in Unit 12 and the estimated sustainable harvest rates, the management objective should be altered for the next report period to reflect the management goal to provide the greatest sustained opportunity to hunt brown bears in Unit 12.

The Unit 20E brown bear management objective was likely not achieved during RY14–RY18. Unitwide harvest likely had little impact on overall population trend, although the harvest may have affected the population locally in the southern portions of the unit. However, no data was collected specifically on brown bear populations nor on brown bear predation on moose calves;

therefore, this management objective ultimately cannot be assessed. Successful reductions in brown bear population size, which have resulted in significant increases in moose calf and/or adult survival, have documented reductions in the bear population of >60% (Ballard and Miller 1990, Keech et al. 2011). This level of reduction in the Unit 20E bear population, even at localized levels, is unlikely given a variety of factors, including difficult access, the lack of a large nearby human population, immigration from nearby lightly hunted areas, and the prohibition to harvest sows with cub/yearlings. Given these factors, the Unit 20E brown bear management objective will be altered for the following report period to reflect the management goal to provide the maximum opportunity to hunt brown bears in the unit. If the public desires a reduction in brown bear predation on moose to increase moose abundance and/or harvestable surplus, this should be conducted via an intensive management predation control plan.

II. Project Review and RY19–RY23 Plan

Review of Management Direction

MANAGEMENT DIRECTION

There are no changes to the management direction for brown bears in Units 12 or 20E for RY19–RY23.

GOALS

The goals will remain as:

Unit 12

G1. Maintain the brown bear population and its habitat in concert with other components of the ecosystem.

G2. Provide the greatest sustained opportunity to hunt brown bears in Unit 12.

Unit 20E

G1. Provide maximum opportunity to hunt brown bears in Unit 20E.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

Brown bears in Units 12 and 20E have a negative customary and traditional use finding, as determined by the Board of Game.

Intensive Management

Not applicable.

MANAGEMENT OBJECTIVES

The management objectives for both Units 12 and 20E brown bears will be modified to the following:

M1. Prohibit the harvest of cubs (within the first 2 years of life) and sows accompanied with cubs.

This is a new management objective for RY19–RY23 for both Units 12 and 20E. Brockman et al. (2020) concluded that the regulatory protection of cubs and sows accompanied by cubs can be used to manage "bear populations that are difficult to monitor to ensure sustainability under relatively light harvest and prevent precipitous declines in populations experiencing heavy harvest." This protection can likely be successfully used to maximize harvest opportunity while providing for sustainable brown bear populations in Units 12 and 20E based upon 1) the recent estimated relatively light unitwide harvest rates, and 2) the distribution of harvest with localized areas of higher harvest (e.g., accessible areas) being surrounded by remote and lightly harvested areas. As previously discussed, if the public desires a reduction in brown bear predation on moose to increase moose abundance and/or harvestable surplus within portions of Units 12 or 20E, this should be conducted via an intensive management predation control plan.

M2. Manage for a stable or increasing trend in harvest.

This is a new management objective for both Units 12 and 20E for RY19–RY23 and will be evaluated via the 5-year average annual harvest for each unit individually. If this objective is not met (i.e., there is a statistically significant decrease in the 5-year average annual harvest), it is meant to serve as a potential signal that brown bear population abundance has declined as a result of harvest above sustainable levels for the population and/or other factors. Multiple studies have concluded that either sex and age composition or morphometric data from harvested animals is of limited utility in detecting changes in brown bear abundance (Harris and Metzgar 1987, McLellan et al. 2016, Brockman et al. 2020). Conversely, harvest data in combination with other metrics was used to evaluate trends in brown bear abundance in British Columbia (Hatter et al. 2018). However, this study used hunter effort metrics in addition to other harvest data (and data unrelated to harvest), and there are obvious drawbacks to drawing conclusions to potential changes in abundance from harvest data without corresponding hunter effort data (Imperio et al. 2010). Nevertheless, especially given the lack of other potential indicators of brown bear population change for the Units 12 and 20E brown bear populations, a significant decrease in harvest that is unrelated to regulatory changes (e.g., more conservative regulations) or the number of unique hunters sealing bears (e.g., fewer hunters harvesting >1 bear in Unit 20E) might indicate a decrease in population abundance and could therefore serve as a signal to implement other monitoring efforts. Other monitoring efforts could include, but are not limited to, measuring hunter effort, further analyses of harvest data (e.g., sex and age composition data), and/or a population survey.

These new management objectives were discussed with the Upper Tanana Fortymile Advisory Committee on 5 January 2021 (the Eagle Advisory Committee did not meet prior to the submission of this report/plan).

REVIEW OF MANAGEMENT ACTIVITIES

1. Population Status and Trend

Activities to assess the Units 12 and 20E brown bear population status and trend are not planned for RY19–RY23. Although information on population status and trend would be useful when evaluating the Unit 12 and 20E management goals and objectives, current options for measuring these parameters are unfeasible in these units given resource constraints (e.g., budget and personnel) and other regional management priorities.

2. Mortality-Harvest Monitoring

ACTIVITY 2.1. Monitor and analyze harvest data.

Data Needs

No change from prior reporting period. Harvest data are necessary to determine whether the management objectives are achieved. In addition, bear bait station registration is necessary to monitor bait station distribution and to disseminate bear baiting information to the public and Board of Game.

Methods

No change from prior reporting period. Harvest will be assessed from sealing records. Bear bait station distribution will be monitored via the mandatory bear bait station registration process.

3. Habitat Assessment-Enhancement

None.

4. Management with Public Participation and Outreach.

ACTIVITY 4.1. Provide information to state and federal regulatory processes on management of this species.

Data Needs

In order for regulatory bodies and the public who engage in regulatory processes to understand the management and biology of brown bears in Units 12 and 20E, it is important for staff to communicate with, coordinate with, and attend meetings of Fish and Game Advisory Committees, the Alaska Board of Game, Federal Regional Advisory Councils, and local village councils. In addition, it is important for staff to review and analyze regulatory proposals to the Alaska Board of Game and the Federal Subsistence Board.

Methods

Tok ADF&G staff will communicate with, coordinate with, and attend meetings of Fish and Game Advisory Committees, the Alaska Board of Game, Federal Regional Advisory Councils, and local village councils about Units 12 and 20E brown bear biology and management and

review and analyze Units 12 and 20E regulatory proposals to the Alaska Board of Game and the Federal Subsistence Board.

ACTIVITY 4.2. Work with local residents and businesses to reduce brown bear/human problems and minimize attractants that may lead to DLPs. In addition, educate the public and remote workers on brown bear awareness and safety and provide education and training on methods to reduce bear/human problems as requested.

Data Needs

Brown bear/human conflict is inevitably negative to the public (e.g., safety concerns) and the local brown bear population (e.g., DLP take); therefore, opportunistic outreach with local residents and businesses is needed to reduce black bear/human conflict.

Methods

Opportunistic outreach with local residents, businesses, and remote workers will occur as needed to reduce brown bear/human conflict in Units 12 and 20E.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

None.

Data Recording and Archiving

- All harvest and sealing data are stored on an internal database housed on ADF&G's Wildlife Information Network (WinfoNet) server (http://winfonet.alaska.gov/index.cfm).
- Electronic copies of pertinent memos, data sheets, and data files are stored in the WinfoNet Data Archive.
- All other electronic files are located on the Tok server (S:\Wells\Brown bear and S:\Wells\Blueberries) with hard copy files stored in the filing cabinet in the Tok office conference room.

Agreements

None.

Permitting

None.

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