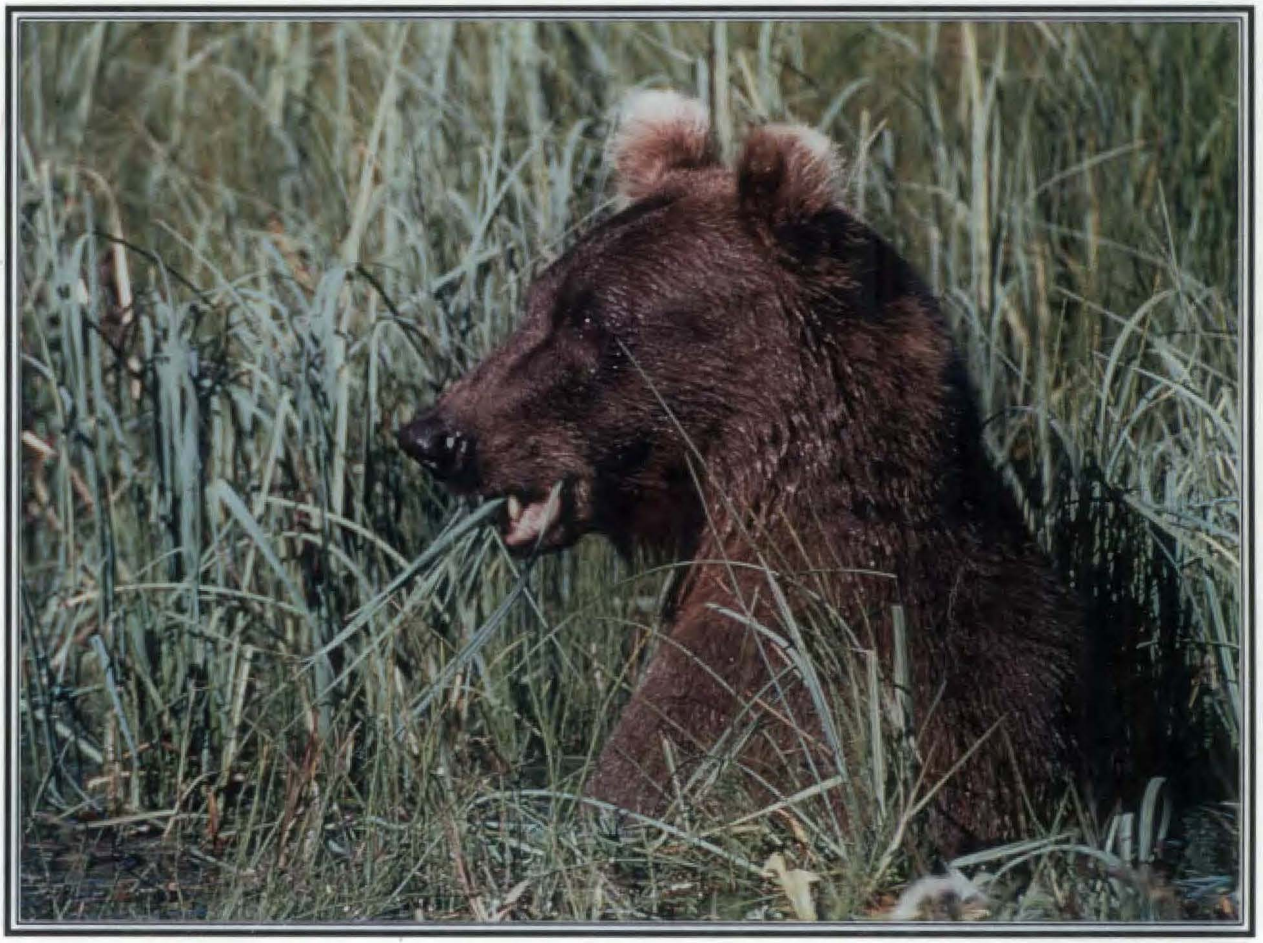
Alaska Department of Fish and Game
Division of Wildlife Conservation

Federal Aid in Wildlife Restoration
Management Report
Survey-Inventory Activities
1 July 1996- 30 June 1998

BROWN BEAR

Mary V. Hicks, Editor



Gerhard Kraus

Grants W-24-5 & W-27-1
Study 4.0
December 1999

STATE OF ALASKA
Tony Knowles, Governor

DEPARTMENT OF FISH AND GAME
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DIVISION OF WILDLIFE CONSERVATION
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Mary Hicks
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ADF&G, Wildlife Conservation
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Juneau, AK 99802
(907) 465-4190

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LOCATION

GAME MANAGEMENT UNIT: 1 (18,500 mi^2)

GEOGRAPHIC DESCRIPTION: The Southeast Alaska mainland from Dixon Entrance to Cape Fairweather, and those islands east of Clarence Strait from Dixon Entrance to Caamano Point, and all islands in Stephens Passage and Lynn Canal north of Taku Inlet.

BACKGROUND

Southeast Alaska brown bears inhabit the islands north of Frederick Sound and the coastal mainland; however, until recently they were only known to coexist with black bears on mainland portions of the panhandle. During the past several years there have been a number of reports of brown bears on islands in Units 1A, 1D, and 3. Although extensive brown bear research has been carried out on Admiralty and Chichagof islands in Unit 4 (Schoen and Beier 1989, Titus and Beier 1993), no brown bear research has been undertaken on Southeast Alaska's mainland. Most of the information we use to assess and manage mainland brown bear populations has come from anecdotal hunter information, occasional staff observations, registration permit hunt reports, and mandatory sealing data.

Before 1968, hunters were allowed to harvest 1 brown bear annually from any part of Alaska from 1 September–10 June. Since that time, hunters have been able to take 1 bear every 4 regulatory years in most parts of the state. Season dates have historically varied from 6 to 9 months during the past 2 decades (Larsen 1993). The current season, which has been in effect since 1989, extends from 1 September–31 December in the fall and 15 March–31 May in the spring. Hunters have been required to obtain registration permits before hunting brown bears in Unit 1 since 1989 (McCarthy 1991, Larsen 1993). Hunters were previously only required to obtain a license and metal-locking tag prior to hunting. Since 1961 brown bear sealing requirements have been in effect in Alaska.

Nearly half of the unit's annual brown bear harvest comes from Unit 1D, located in the northern part of the region (Haines area). Units 1A (Ketchikan area), 1B (Wrangell/Petersburg area), and 1C (Juneau area) each account for 5–40% of the annual harvest. All nonresident hunters are required to hunt brown bears with a registered guide or a relative within the second degree of kindred. Because of the trophy status associated with brown bears and because hunters must wait 4 seasons between hunts, hunters often do not select small bears but wait to harvest a large brown bear. This partly accounts for the relative low success rates noted for brown bear hunters in Southeast Alaska.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

- Maintain an average age of annually harvested males no less than 6.5 years, with a male to female harvest ratio of at least 3:2.

- Reduce the number of bears killed because of garbage habituation.

METHODS

We collect brown bear harvest data through registration permit reports and a mandatory sealing program. At the time of sealing, we record the sex of harvested bears along with the date and kill location. We also measure lengths and zygomatic widths of bear skulls and extract a premolar tooth. At the end of each season, we send all extracted premolars to Matson's Laboratory (Bozeman, Montana USA) for aging.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Quantitative population data are not available for brown bears in Unit 1. Based on anecdotal hunter reports, department staff observations, and sealing records, we believe the population remained stable during this report period.

MORTALITY

Harvest

Season and Bag Limit:	Resident and nonresident hunters
15 Sep–31 Dec.	1 bear every 4 regulatory years
15 Mar–31 May	by registration permit only.

Board of Game Actions and Emergency Orders. No Board of Game actions have been made since the 1989 implementation of the existing Unit 1 registration permit requirement. No emergency closures have been necessary to date.

Hunter Harvest. The Unit 1 1997–98 harvest of 35 bears was the second highest on record. Unit 1A and 1B harvests were below the 10-year average (Table 1). The Unit 1D harvest of 21 bears during 97–98 was the highest on record. Unit 1D continued to account for over half of the bears harvested from Unit 1.

One male from Unit 1B and 1 female from Unit 1C were killed in defense of life or property (DLP) incidents during fall 1997, both by resident hunters. One male bear in 1997 and 2 males during 1998 were taken illegally from Unit 1C by hunters who failed to obtain registration permits. This was down from the 5 DLP kills reported during 1992–94 but similar to the 1994–96 seasons (Table 2). One male was taken out of season during fall 1997 from Unit 1C by a resident hunter who mistook it for a black bear. We derived the estimated human-caused mortality for Unit 1 by adding the reported harvest, DLP kills, and known and estimated unreported/illegal harvests. The estimates for 1996–98 were similar to those derived in past years (Table 2). Unreported kills are estimated at 10% of the reported harvest, although this is considered conservative (McCarthy 1991) (Table 2). Two

additional bears were killed under DLP provisions during 1998 on Wrangell Island and Mitkof Island in Unit 3, which has no open brown bear season.

Harvests of males have consistently surpassed our management objective of 60% (Table 2). During the past 2 seasons, males composed 69% and 72% of the annual harvests, respectively, putting the harvest well within our male to female harvest objective ratio. Harvests are most noticeably skewed toward males during spring seasons (Table 2). We suspect that this is at least partly due to the fact that it is illegal to harvest females accompanied by cubs. As sows with second-year cubs separate at the end of spring seasons, sows become legal to hunters, and the proportion of females in the harvest increases during fall.

The mean skull size of male brown bears harvested during the past 2 seasons was higher than the long-term average. The 1997 season male average of 22.8 inches was the third highest on record. Female skull sizes were slightly lower than in previous years, while the mean ages were similar. The 92–93 and 97–98 seasons exhibited the 2 highest harvests (n = 14) of female bears since 1985.

The mean age of harvested male bears was similar to past years (7.3 years) and is well within our objective of maintaining an average male age of 6.5 years. Although average male skull sizes were large, the harvest consisted of many younger bears. During the 96–97 and 97–98 seasons, 16 and 23 harvested bears were ≤ 5 years of age, respectively (range = 2–5 years). Young bears accounted for nearly 50% of the total harvest during each of the past 2 seasons.

Permit Hunts. Registration permits have been required by Unit 1 brown bear hunters since fall 1989 (Table 4). Compliance with the permit conditions has been excellent during the past several seasons, although it has required that we put much postseason effort into contacting delinquent hunters and reminding them to provide us with required hunt information. Only 1 hunter during each of the 2 recent seasons failed to file a hunt report.

Hunter Success and Residency. Similar to past seasons, about half of the permittees during each year did not hunt (Table 4). Of the 152 hunters in 96–97, 24% were successful. Similarly, during 97–98 a total of 166 hunters went afield and 27% of those were successful. Hunter success rates for fall (20%) and spring (22%) remained similar during this report period.

For the second time on record, nonresident hunters accounted for more bear harvests than local and nonlocal residents (Table 5). During 1996–97 nonresidents harvested 17 bears, compared with 18 during 1997–98. We attribute this to a marked increase in registered guide activity in the unit during the past 2 seasons. Local residents had the lowest success rate on record during 96–97 and 97–98 regulatory years—29% and 26%, respectively. Nonlocal resident success remained similar to the past 10-year average.

Harvest Chronology. During many of the past 11 seasons, the Unit 1 brown bear harvest has been somewhat evenly split between fall and spring seasons. There has been a

progressive increase in the spring harvest during the past 2 seasons that has accounted for 75% of the total (Table 6). Most brown bears harvested from Unit 1 are taken during May (Table 7). September has consistently been the second highest annual harvest month and has accounted for most of the fall-harvested bears (Table 7).

Transport Methods. Most Unit 1 brown bear hunters continue to use boats to access the remote, mostly roadless hunting areas (Table 8).

HABITAT

Assessment

Timber harvest and mineral exploration and development pose the most serious threats to brown bear habitat in Unit 1. Although this has been especially true in Units 1B and 1C, future timber harvest scheduled to occur on the Cleveland Peninsula in Unit 1A will similarly impact brown bear habitat. Bear/human interactions and conflicts resulting from increased access and development continue to concern us. DLP mortalities are an ever-present possibility where bears become attracted and accustomed to garbage dumps created by new logging and mining camps.

CONCLUSIONS AND RECOMMENDATIONS

The registration permit first implemented in 1989 continues to provide us with useful information about brown bear hunting effort and success in Unit 1. We have achieved our objective of having a 3:2 harvest ratio of males to females during the past 2 seasons and 11 of the past 13 seasons.

The harvest objective of maintaining an average age of 6.5 years for male bears was met during both the 96–97 and 97–98 seasons. Ages of harvested males have averaged above our objective of 6.5 years during 12 of the past 13 seasons. The skull sizes were larger than average during the report period yet included many young bears. Over half the bears killed during the 96–97 and 97–98 regulatory years were 5 years of age or younger. Guided hunters took 5 of these young bears during each of the 2 years. This points out that it is not simply new hunters who have difficulty judging mature bears.

Spring and fall hunter success remained similar during the 96–97 and 97–98 seasons. Over 56% of the total number of bears harvested were taken during spring.

The lack of DLP kills during 1996–97 and the 2 reported during 1997–98 show a marked decrease from previous years, thereby meeting our objective of reducing the number of bears killed because of garbage habituation in the unit. Despite this 2-year decrease, we recognize that the long-term success in reducing bear/human conflicts lies directly with the public's willingness to adopt and adhere to responsible garbage management.

Based on harvest data, staff observations, and reports by the public, we could not determine any change in the Unit 1 brown bear population during this report period. We see no reason to modify the season or bag limit at this time, although we intend to closely monitor the increasing guide activity in the unit.

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PREPARED BY:

Boyd Porter
Wildlife Biologist II

SUBMITTED BY:

Bruce Dinneford
Management Coordinator

Table 1 Unit 1 brown bear harvests, 1985–1997[a]

Regulatory year	Unit 1A		Unit 1B		Unit 1C		Unit 1D		Total harvest
	Harvest	% of total	Harvest	% of total	Harvest	% of total	Harvest	% of total	
1985/86	1	(4)	7	(30)	6	(26)	9	(39)	23
1986/87	2	(13)	2	(13)	5	(33)	6	(40)	15
1987/88	8	(24)	4	(12)	3	(9)	18	(55)	33
1988/89	4	(25)	2	(12)	3	(19)	7	(44)	16
1989/90	4	(20)	4	(20)	1	(5)	11	(55)	20
1990/91	5	(19)	5	(18)	4	(15)	13	(48)	27
1991/92	4	(15)	6	(24)	4	(15)	12	(46)	26
1992/93	7	(19)	8	(21)	4	(11)	18	(49)	37
1993/94	4	(17)	3	(12)	6	(25)	11	(46)	24
1994/95	8	(28)	5	(17)	3	(10)	13	(45)	29
1995/96	3	(15)	8	(40)	1	(5)	8	(40)	20
1996/97	4	(13)	4	(13)	7	(22)	16	(52)	31
1997/98	5	(14)	4	(12)	5	(14)	21	(60)	35
Total	59	(18)	62	(18)	52	(15)	163	(49)	336

[a]Does not include bears killed in defense of life or property, research mortalities, illegal harvests, or other human/caused accidental mortalities.

Table 2 Unit 1 brown bear harvest, 1985–1997

Regulatory year	Reported							Estimated kill				
	Hunter kill				Nonhunting kill[a]			Unreported illegal[b]	Total estimated kill			
	M (%)	F (%)	Unk.	Total	M	F	Unk.		M (%)	F (%)	Unk.	Total
Fall 1985	(30)	(70)	1	11	3	0	0	1	(46)	(54)	2	15
Spring 1986	(82)	(18)	1	12	1	0	0	1	(83)	(17)	2	14
Total	(57)	(43)	2	23	4	0	0	2	(64)	(36)	4	29
Fall 1986	(40)	(60)	0	10	0	0	0	1	(40)	(60)	1	11
Spring 1987	(80)	(20)	0	5	0	0	0	1	(80)	(20)	1	6
Total	(53)	(47)	0	15	0	0	0	2	(53)	(47)	2	17
Fall 1987	(73)	(27)	2	17	0	0	0	2	(73)	(27)	4	19
Spring 1988	(53)	(47)	1	16	1	0	0	1	(56)	(44)	2	18
Total	(63)	(37)	3	33	1	0	0	3	(67)	(33)	6	37
Fall 1988	(60)	(40)	0	5	1	1	0	1	(67)	(33)	1	8
Spring 1989	(82)	(18)	0	11	0	0	0	1	(82)	(18)	1	12
Total	(75)	(25)	0	16	1	1	0	2	(72)	(28)	2	20
Fall 1989[c]	(67)	(33)	1	10	0	0	0	1	(67)	(33)	2	11
Spring 1990	(80)	(20)	0	10	0	1	0	1	(73)	(27)	1	12
Total	(74)	(26)	1	20	0	1	0	2	(70)	(30)	3	23
Fall 1990	(72)	(28)	0	18	1	1	2	2	(75)	(25)	2	24
Spring 1991	(100)	(0)	0	9	0	0	0	1	(100)	(0)	1	10
Total	(81)	(19)	0	27	1	1	2	3	(79)	(21)	3	34
Fall 1991	(50)	(50)	0	12	1	1	0	1	(50)	(50)	0	15
Spring 1992	(78)	(22)	0	14	0	0	0	1	(78)	(22)	0	15
Total	(65)	(35)	0	26	1	1	0	2	(64)	(36)	0	30
Fall 1992	(52)	(48)	0	25	0	0	0	3[d]	(52)	(48)	0	28
Spring 1993	(91)	(09)	0	12	4	0	0	1	(94)	(06)	0	17
Total	(64)	(36)	0	37	4	0	0	4	(62)	(38)	0	45
Fall 1993	(75)	(25)	0	12	1	0	0	1	(77)	(25)	0	14
Spring 1994	(75)	(25)	0	12	0	0	0	2[e]	(75)	(25)	0	13
Total	(75)	(25)	0	24	1	0	0	2	(76)	(24)	0	27
Fall 1994	(42)	(58)	0	12	0	1	0	2[f]	(40)	(60)	0	15
Spring 1995	(76)	(24)	0	17	0	0	0	2	(74)	(26)	0	19
Total	(62)	(38)	0	29	0	1	0	4	(59)	(41)	0	34

Table 2 Continued

Regulatory year	Reported							Estimated kill				
	Hunter kill				Nonhunting kill[a]			Unreported illegal[b]	Total estimated kill			
	M (%)	F (%)	Unk.	Total	M	F	Unk.		M (%)	F (%)	Unk.	Total
Fall 1995	(75)	(25)	0	8	0	2	0	2[g]	(58)	(42)	0	12
Spring 1996	(83)	(17)	0	12	0	0	0	2[h]	(86)	(14)	0	14
Total	(80)	(20)	0	20	0	2	0	4	(69)	(31)	0	26
Fall 1996	(54)	(46)	0	13	0	0	0	0	(54)	(46)	0	13
Spring 1997	(78)	(22)	0	18	0	0	0	1[f]	(78)	(22)	0	19
Total	(68)	(32)	0	31	0	0	0	1	(69)	(31)	0	32
Fall 1997	(63)	(37)	0	16	1	1	0	2[j]	(65)	(35)	0	20
Spring 1998	(84)	(16)	0	19	0	0	0	0	(84)	(16)	0	19
Total	(74)	(26)	0	35	1	1	0	2	(74)	(26)	0	39

[a] Includes DLP kills, research mortalities, and other known human/caused accidental mortalities.
[b] Estimated to be 10% of reported kill (McCarthy 1991).
[c] First season registration permits required for hunting brown bear.
[d] One female was illegally killed and left along Fish Creek in Hyder, AK.
[e] Includes 1 male illegally killed at a black bear bait station in Unit 1D, and 1 female killed in Unit 1C by a hunter who failed to obtain a registration permit.
[f] One male, one female killed by hunters who failed to obtain registration permits.
[g] One male, 1 female taken illegally.
[h] Two males taken by hunters who failed to obtain registration permits.
[i] One male taken by a hunter who failed to obtain registration permit.
[j] One male and 1 female taken by hunters who failed to obtain registration permits.

Table 3 Ages and skull sizes of brown bears harvested in Unit 1, 1985–1997

	Mean skull size[a]				Mean age[b]			
Season	Male	Nr.	Female	Nr.	Male	Nr.	Female	Nr.
1985/86	22.3	12	20.5	8	9.1	11	6.5	8
1986/87	23.2	7	20.7	7	9.4	7	10.2	7
1987/88	21.4	18	20.6	11	5.5	17	7.7	7
1988/89	22.7	12	19.4	4	8.4	11	5.2	3
1989/90	21.2	14	20.6	5	6.7	13	7.4	5
1990/91	21.5	22	18.7	5	7.9	20	5.2	5
1991/92	21.6	13	20.4	8	7.4	14	7.9	6
1992/93	21.9	24	20.0	13	7.4	24	7.4	14[c]
1993/94	21.9	16	20.3	6	6.4	16	3.4	5
1994/95	22.9	18	20.5	11[c]	7.9	13	7.3	12[c]
1995/96	21.7	18[d]	21.4	4	6.6	12	16.0	3
1996/97	22.7	22	19.9	10	8.5	22	6.6	10
1997/98	22.8	27	20.8	10	7.3	24	7.8	14

[a] Skull size equals length plus zygomatic width.

[b] Determined through analyses of extracted premolar teeth.

[c] Includes 1 female taken illegally by a hunter who failed to obtain a registration permit.

[d] Includes 2 males taken illegally in Unit 1C by hunters who failed to obtain registration permits.

Table 4 Unit 1 brown bear registration permit data, 1989–1997

Season/ hunt nr.	Year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bear harvest			
						Males (%)	Females (%)	Unknown	Total
(Fall)									
278F	1989[a]	44	(0)	(95)	(5)	(50)	(50)	0	2
278F	1990	67	(0)	(73)	(27)	(72)	(28)	0	18
272F	1991	182	(47)	(48)	(5)	(50)	(50)	0	12
272F	1992	149	(46)	(37)	(17)	(56)	(44)	0	25
272F	1993	146	(53)	(39)	(8)	(75)	(25)	0	12
272F	1994	135	(58)	(33)	(9)	(42)	(58)	0	12
272F	1995[b]	164	(55)	(39)	(6)	(67)	(33)	0	9
272F	1996[d]	147	(54)	(36)	(9)	(54)	(46)	0	13
272F	1997	175	(52)	(39)	(9)	(63)	(37)	0	16
(Spring)									
278S	1990	60	(0)	(88)	(12)	(71)	(29)	0	7
278S	1991	59	(0)	(86)	(14)	(100)	(0)	0	9
272S	1992	142	(49)	(41)	(10)	(79)	(21)	0	14
272S	1993	131	(43)	(48)	(9)	(91)	(9)	0	11
272S	1994	133	(50)	(42)	(8)	(75)	(25)	0	12
272S	1995[c]	156	(43)	(46)	(11)	(76)	(24)	0	17
272S	1996	139	(44)	(47)	(9)	(83)	(17)	0	12
272S	1997	144	(40)	(47)	(13)	(78)	(22)	0	18
272S	1998	152	(46)	(41)	(13)	(84)	(16)	0	19
Total	1989/90	104	(0)	(91)	(9)	(67)	(33)	0	9
	1990/91	126	(0)	(79)	(21)	(81)	(19)	0	27
	1991/92	324	(48)	(45)	(7)	(65)	(35)	0	26
	1992/93	280	(44)	(43)	(13)	(64)	(36)	0	36
	1993/94	279	(51)	(41)	(8)	(75)	(25)	0	24
	1994/95	291	(49)	(41	(10)	(62)	(38)	0	29
	1995/96	303	(50)	(43)	(7)	(80)	(20)	0	20

Table 4 Continued

Season/ hunt nr.	Year	Permits Issued	Percent did not Hunt	Percent unsuccessful hunters	Percent successful hunters	Bear harvest			
						Males (%)	Females (%)	Unknown	Total
	1996/97	291	(47)	(42)	(11)	(68)	(32)	0	31
	1997/98	327	(49)	(40)	(11)	(74)	(26)	0	35

[a] First season permits required for hunting brown bear.
[b] Three hunters did not return permits.
[c] Two hunters did not return permits.
[d] One hunter did not return permit.

Table 5 Unit 1 successful brown bear hunters residency, 1985–1997[a]

Regulatory year	Local resident[b] (%)	Nonlocal resident (%)	Nonresident (%)	Unknown	Total successful hunters
1985/86	(61)	(26)	(13)	0	23
1986/87	(60)	(27)	(13)	0	15
1987/88	(58)	(27)	(12)	3	33
1988/89	(56)	(19)	(25)	0	16
1989/90[c]	(45)	(25)	(30)	0	20
1990/91	(63)	(7)	(26)	1	27
1991/92	(65)	(4)	(23)	2	26
1992/93	(47)	(8)	(45)	1	37
1993/94	(54)	(21)	(25)	0	24
1994/95	(38)	(21)	(41)	0	29
1995/96	(30)	(15)	(55)	0	20
1996/97	(29)	(16)	(55)	0	31
1997/98	(26)	(23)	(31)	0	35

[a] Does not include illegal harvests.

[b] Local residents are those hunters who reside in Unit 1.

[c] Before 1989/90 all harvest data were obtained solely from sealing records.

Table 6 Unit 1 brown bear seasonal harvest chronology, 1985–1997[a]

	Fall		Spring	
Year	Harvest	Percent of total	Harvest	Percent of total
1985/86	12	(52)	11	(48)
1986/87	5	(33)	10	(67)
1987/88	16	(48)	17	(52)
1988/89	11	(69)	5	(31)
1989/90	10	(50)	10	(50)
1990/91	18	(67)	9	(33)
1991/92	12	(46)	14	(54)
1992/93	25	(68)	12	(32)
1993/94	12	(50)	12	(50)
1994/95	12	(41)	17	(59)
1995/96	8	(40)	12	(60)
1996/97	16	(46)	19	(54)
1997/98	13	(42)	18	(58)
Total	170	(51)	166	(49)

[a] Does not include illegal harvests.

Table 7 Unit 1 brown bear monthly harvest chronology, 1985–1997[a]

Regulatory year	Harvest periods							
	September	October	November	March	April	May	June	Nr.
1985/86	6	4	1	0	0	12	0	23
1986/87	6	2	2	0	1	4	0	15
1987/88	9	4	4	0	0	15	1	33
1988/89	2	2	1	0	0	10	1	16
1989/90	2	7	1	0	0	10	0	20
1990/91	9	8	1	0	1	8	0	27
1991/92	8	2	2	1	0	13	0	26
1992/93	14	10	1	0	3	9	0	37
1993/94	6	5	1	0	1	11	0	24
1994/95	8	3	1	0	1	16	0	29
1995/96	3	4	1	0	0	12	0	20
1996/97	10	3	0	0	3	15	0	31
1997/98	7	9	0	0	1	18	0	35
Total	90	63	16	1	11	153	2	336

[a] Does not include illegal harvests.

Table 8 Unit 1 successful brown bear hunter transport methods, 1985–1997[a]

Regulatory year	Percent of Harvest						Nr.
	Airplane	Boat	Walk	ORV	Highway vehicle	Other/ unknown	
1985/86	(4)	(61)	(4)	(9)	(13)	(9)	23
1986/87	(7)	(53)	(0)	(13)	(27)	(0)	15
1987/88	(12)	(52)	(9)	(12)	(6)	(9)	33
1988/89	(6)	(63)	(6)	(6)	(13)	(6)	16
1989/90	(10)	(70)	(5)	(5)	(5)	(5)	20
1990/91	(15)	(52)	(7)	(15)	(4)	(7)	27
1991/92	(8)	(62)	(0)	(8)	(3)	(19)	26
1992/93	(17)	(50)	(0)	(3)	(30)	(0)	37
1993/94	(0)	(71)	(4)	(0)	(25)	(0)	24
1994/95	(3)	(76)	(7)	(0)	(14)	(0)	29
1995/96	(0)	(70)	(5)	(0)	(25)	(0)	20
1996/97	(3)	(71)	(3)	(3)	(20)	(0)	31
1997/98	(3)	(66)	(0)	(0)	(31)	(0)	35

[a] Does not include illegal harvests.

LOCATION

GAME MANAGEMENT UNIT: Unit 4 (5800 mi^2)

GEOGRAPHIC DESCRIPTION: Admiralty, Baranof, Chichagof, and adjacent islands

BACKGROUND

Brown bears inhabit all the major islands in Game Management Unit 4 (Admiralty, Baranof, Chichagof, Kruzof, Yakobi, and Catherine Islands). The population has been isolated from mainland brown/grizzly bear populations for over 40,000 years and is genetically distinct from other bears (Heaton et al. 1996, Talbot and Shields 1996).

Management of Unit 4 brown bears has had a colorful and controversial past. In the early part of the century, there were advocates for both complete elimination of and for more reasonable preservation of brown bears. Market hunting for hides and calls for the elimination of bears were gradually overcome by support for greater protection for the valuable bear resource (Paul 1998), and the department developed more restrictive harvest regulations.

The Tongass National Forest encompasses most Unit 4 bear habitat and is managed under a multiple use concept by the U.S. Forest Service (FS). On both Federal and private lands there has been extensive long-term habitat alteration by commercial logging. Wilderness designations on Admiralty, south Baranof, and west Chichagof Islands, however, contain large areas that should continue to provide bears with pristine environments. Elsewhere in the unit, habitat alteration by logging will impact brown bear density and distribution.

Unit 4 includes the most important brown bear hunting area in Southeast Alaska. Unit 4 has nearly 70% of the estimated brown bears (Miller 1993*a*) and has produced 67% of the harvest in recent years (Miller 1993*b*). Federal assumption of subsistence management under the terms of the Alaska National Interest Lands Conservation Act (ANILCA) included authority for brown bears on Federal lands. This dual authority with the State of Alaska has confused the public and may deny state wildlife managers the use of options available in other areas.

Three areas in Unit 4 are closed to bear hunting to enhance viewing opportunities: Seymour Canal Closed Area on eastern Admiralty Island, which encompasses the Stan Price State Wildlife Sanctuary; Salt Lake Closed Area at Mitchell Bay on southwest Admiralty Island; and the Port Althorp Closed Area on northern Chichagof Island.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

None established.

MANAGEMENT OBJECTIVES

- Maintain an average age of harvested males of at least 6.5 years.

- Maintain a male to female harvest ratio of at least 3:2.
- Reduce the number of bears killed in defense of life or property (DLP).

METHODS

Registration permits for Unit 4 brown bear hunting were issued to the public at Alaska Department of Fish & Game (ADF&G) offices. Successful bear hunters were required to present skulls and hides to a representative of the Division of Wildlife Conservation (DWC) or the Division of Fish & Wildlife Protection for sealing. Bear sealers measured skulls, extracted premolars, determined sex, and recorded data on the date and location of kill, hunter residency, hunt length, guide services used (if any), and primary transportation. A commercial laboratory determined ages through cementum annuli analyses in premolars. All persons obtaining permits were required to report on their use of the permit immediately after taking a bear or following the close of the season.

Data recorded on sealing forms and registration permit reports were entered into a computer database. Delinquent permittees were sent reminder letters and certified letters to improve reporting compliance. The Alaska Department of Public Safety cited permittees who failed to report.

Project personnel attempted to reduce defense of life or property (DLP) incidents through education and cooperation with community authorities and other agencies.

Personnel from DWC and FS contacted visitors at Pack Creek in the Stan Price State Wildlife Sanctuary. The program was staffed from late June through August to interpret bear behavior and management, promote public safety, prevent DLP loss of habituated bears, and explain regulations associated with the cooperative management area.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Brown bear populations in Unit 4 are stable (Miller 1993*a*). Analysis of historical harvest data indicates that bear numbers probably declined during the mid-1970s but have since recovered (Faro 1997). Harvest levels from some areas of the unit continue to warrant close scrutiny. Expansion of logging roads, particularly on northeast Chichagof Island, has increased the vulnerability of bears to hunters. High harvest occurs because logging roads allow hunters greater efficiency in accessing salmon streams, bays, and estuaries (Young 1989, 1990; Titus and Beier 1992).

Population Size

Titus and Beier (1993) reported bear densities on Admiralty and Northeast Chichagof islands study areas. These studies provide the basis for population estimates for major areas of the unit. The current population estimate for the entire unit is 4155 bears; Chichagof and adjacent islands, 1550; Baranof and adjacent islands, 1045; and Admiralty Island, 1560. For management

purposes, the lower 95% confidence limit is used as a conservative population level, and we have attempted to maintain harvests at 4% or less of that population.

Population Composition

Data are limited on the population composition of the Unit 4-wide population of brown bears. The number of bears captured during ADF&G Wildlife Conservation research programs has been small, and we believe capture bias has resulted in a sample not representative of the sexes and age classes of bears in the population. Age and sex data from hunter harvest are biased by hunter selectivity, the vulnerability of young bears, regulations protecting females with offspring, and misidentification of harvested bears by sealers.

In Unit 4 the 1996–97 harvest by hunters was 81% males (n = 104) and 19% females (n = 25). The 1997–98 harvest was 80% males (n = 107) and 20% females (n = 27). Table 1 displays sex information for the last 5 regulatory years.

Distribution and Movements

Researchers continued to monitor radiocollared bears on the Northeast Chichagof Controlled Use Area (NECCUA) and Admiralty Island to gather basic life history data. Sample sizes are small, but indications are that adult bears tend to make little change in home ranges once they have become established. Some subadults, particularly males, make extensive movements from their mothers' home ranges. The importance of subadult dispersal in maintaining viable brown bear populations is poorly understood.

MORTALITY

Harvest

Season and Bag Limit	Resident and Nonresident Hunters
Unit 4: Chichagof Island south and west of a line which follows the crest of the island from Rock Point (58° N. lat, 136°21' W. long.) to Rodgers Point (57°35'N. lat., 135°33'W. long.), including Yakobi and other adjacent islands; Baranof Island south and west of a line which follows the crest of the island from Nismeni Point (57°34'N. lat., 135°25'W. long.), to the entrance of Gut Bay (56°44'N. lat., 134°38'W. long.), including the drainages into Gut Bay and including Kruzof and other adjacent islands.	Sep 15–Dec 31 Mar 15–May 31
One bear every 4 regulatory years by registration permit only	
Unit 4: that portion in the Northeast Chichagof Controlled Use Area north of the Spasski Trail and the Gartina Highway	Sep 15–Sep 30 Mar 15–May 20

and the Gartina Highway

One bear every 4 regulatory years by registration permit only

Unit 4: remainder of the Northeast Chichagof Controlled Use Area — Mar 15–May 20

One bear every 4 regulatory years by registration permit only

Remainder of Unit 4: — Sep 15–Dec 31, Mar 15–May 20

One bear every 4 regulatory years by registration permit only

Board of Game Actions and Emergency Orders. No Board actions were taken and no emergency orders were issued during the period.

Hunter Harvest.

Regulatory Year 1996–97: Hunters took 34 brown bears in fall 1996 and harvested 95 in spring 1997. The total for the year was 129 bears. An additional 19 bears are known to have died, bringing the year's total to 148 bears.

Regulatory Year 1997–98: Hunters took 26 bears in fall 1997 and 108 in spring 1998. Hunting accounted for 134 bears and 8 other bears were reported killed; the combined mortality for the year was 142 bears. Data concerning brown bear harvests for the past 5 years are presented in Tables 1 and 2.

For Admiralty Island harvested females, the mean age was 8.5 years (n = 13) in 1996–97, while males averaged 7.7 years (n = 39). The average male skull measurement totaled 22.0 inches (n = 40) in 1996–97; for females, average skull measurement was 20.1 inches (n = 13). Long-term trends in skull measurements closely match those found in the age data, indicating stable trends. Ages and skull sizes for Baranof and Chichagof Islands are comparable to Admiralty data, also indicating a stable trend.

Year to year harvest variation can create problems when making short-term management decisions. Miller and Miller (1990) advise caution when interpreting harvest data but felt it was a useful indicator of long-term trends. For the larger islands, long-term trends in sex, age, and skull measurements appear relatively stable within established parameters.

Hunter Residency and Success. Management of the registration permit hunt areas is now under a registration permit that covers more than 1 hunt area each season. Hunting pressure in each area is determined from the permit hunt reports at the end of the season. Table 4 summarizes the data for each area with distinct season dates.

Local residents of Unit 4 take a small percentage of the total annual harvest (Table 3). Most bears were taken by nonresidents or Alaska hunters from other areas of the state. In 1996–97 nonlocal Alaska hunters and nonresidents harvested 88% of the bears. In 1997–98 nonresidents and nonlocal Alaskans took 90% of the bears.

Spring and fall hunting effort is presented in Table 4. In fall 1996, 57 Alaska residents hunted a total of 249 days, while 38 nonresidents spent 172 days afield. In fall 1997, 63 residents hunted 322 days and 36 nonresidents hunted 209 days. Spring seasons produce a larger harvest (Table 1) and have the greater hunting pressure (Table 4). In spring 1997, 107 residents hunted 384 days and 89 nonresidents hunted 497 days. In spring 1998, 130 residents hunted 536 days and 115 nonresidents hunted 707 days. Fall seasons produced 1 bear for every 15.9 hunt days, and spring seasons produced 1 bear for every 10.5 days.

Harvest Chronology. Most fall harvest occurs during the first 2 weeks of the season (Table 5). The greatest hunting pressure occurs early because weather is generally more favorable and many bears have not yet left salmon streams. Adverse weather and dispersal from the streams make it increasingly difficult to locate bears late in the fall season. A high percentage of females characteristically are in the fall harvest (Table 1).

The percentage of male bears killed in spring seasons is higher than in the fall, but the actual number of females killed is frequently greater (Table 1). The greatest numbers of bears are available to hunters late in the spring season because nearly all bears have left their dens and are seeking food. Most spring bears are killed in May (Table 5). In late springs, bears concentrate and feed on grass flats near salt water. In such years, harvests are higher than in years with early "green-up" that provide bears with more dispersed feeding opportunities.

Transport Methods. Bear hunters use boats as the most common form of transportation in Unit 4 (Table 6). In 1996–97, 93% of the successful hunters used boats. In 1997–98, successful hunters used boats 88% of the time. Aircraft are the second most important means of hunter transport but were used by only 5% and 10% of successful hunters in the 1996–97 and 1997–98 seasons, respectively.

Other Mortality

To reduce DLP mortality, we worked with local communities and agencies associated with public safety. Most nonhunting mortality results from bears entering areas developed for human use. Such situations are most effectively addressed by eliminating improper garbage disposal or food storage. Few DLP incidents occur that do not involve bears that have previously been habituated to humans.

In 1996–97, 19 nonhunting mortalities were reported (Table 1); only 8 occurred in 1997–98. Of these 27 bears, 9 were illegal kills (generally related to improper paperwork), 1 was a roadkill, and 17 were taken under DLP provisions. The distribution of this mortality was as follows: Admiralty Island, 10 bears with 2 killed near the community of Angoon; Baranof/Kruzof islands, 7 bears with 1 killed near Port Alexander; NECCUA, 9 bears with 5 killed near Hoonah; and the remainder of Chichagof Island, 1 bear killed.

Bear Viewing. Public interest in viewing bears has steadily increased at the Stan Price State Wildlife Sanctuary. During summer 1996, 1241 people visited the sanctuary, and in 1997 the number of visitors was 1381.

CONCLUSIONS AND RECOMMENDATIONS

Management objectives for harvested male brown bear ages were met in both years. On Admiralty Island the average age for the 1996–97 regulatory year was 7.7 years. For Baranof and Chichagof Islands, mean ages were 8.2 and 7.8 years, respectively. Mean ages of harvested bears from all subpopulations exceed the 6.5-year minimum objective. The male to female harvest ratio was 3:0.7 in 1996–97 and 3:0.8 in 1997–98, not meeting the management objective of 3:2.

The objective of reducing the loss of bears due to DLP mortality is difficult to measure. DWC continued to work with FS and the Alaska Department of Environmental Conservation to address landfill problems in logging camps and communities that contribute to such losses.

For harvest purposes, Admiralty Island, Chichagof/Yakobi islands, and Baranof/Kruzof Islands are managed as 3 subpopulations. These areas are large enough to encompass viable bear populations, and water barriers probably restrict dispersal of subadults between the areas. Hunting pressure on brown bears in the unit requires the use of all available information concerning the population status for management actions. None of these subpopulations is currently experiencing excessive human-induced mortality; mortality levels (Table 2) are below the conservative guideline of 4% of the population, recommended by Titus (pers commun). Attempts to "micro-manage" by smaller areas (with the possible exception of NECCUA) could redirect hunting pressure and create a "domino effect" of management problems. Future seasons may require some regulatory change in specific areas that receive high hunter effort to maintain biological or aesthetic standards. More information on Unit 4 brown bear movements is necessary before attempting management of smaller subpopulations.

The level of bear mortality on Chichagof Island including NECCUA remains a concern. Extension of the controlled use area in 1994 to north of Port Frederick due to extensive logging road construction appears to have prevented excessive harvest. Chichagof Island has experienced the greatest long-term habitat alteration from logging of all Unit 4 areas, thus bear habitat here is the least secure in the unit. Continuing research on the island's bear population is necessary to provide managers with population information.

The combined annual mortality from harvest and DLP kills in the unit is close to the biological guideline of 4% of the estimated population (Table 2). Increases in harvest may make it necessary to recommend regulatory changes to dampen the trend of increasing bear kills. Increased harvests by nonresidents are expected, and the harvest guideline for some areas soon may be exceeded. Currently the FS is exploring a system of limiting commercial services that could again restrict guide services. ADF&G should cooperate with this program by providing the FS with information on historical bear harvest and guiding effort.

Funding for the Pack Creek bear-viewing program with traditional "hunting-generated funds" has become increasingly controversial. We need to develop a secure source of funding to maintain

this popular "nonhunting" activity. Currently about 50% of the funds needed to operate the Admiralty Island site come from visitor fees, and the balance from the State General Fund.

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PREPARED BY:

Jackson S. Whitman
Wildlife Biologist III

SUBMITTED BY:

Bruce Dinneford
Management Coordinator

Table 1 Unit 4 brown bear harvest, 1993–1994 through 1997–1998

Regulatory year	Hunter kill					Nonhunting kill[a]				Total reported
	M	F	(%F)	Unk	Total	M	F	Unk	Total	
1993										
Fall 93	15	13	(46)	0						
Spring 94	52	22	(30)	0						
Total	67	35	(34)	0	102	3	1	1	5	107
1994										
Fall 94	11	8	(42)	0						
Spring 95	72	20	(22)	0						
Total	83	28	(25)	0	111	4	3	0	7	118
1995										
Fall 95	23	11	(32)	0						
Spring 96	66	24	(27)	0						
Total	89	35	(28)	0	124	5	7	3	15	139
1996										
Fall 96	23	11	(32)	0						
Spring 97	81	14	(15)	0						
Total	104	25	(19)	0	129	11	5	3	19	148
1997										
Fall 97	14	12	(46)	0						
Spring 98	93	15	(14)	0						
Total	107	27	(20)	0	134	4	3	1	8	142

[a] Includes Defense of Life or Property kills, research mortalities, and other known human caused accidental mortality. Does not include bears that were found dead.

Table 2 Brown bear hunting pressure[a] and mortality[b] by major geographic areas in Unit 4, regulatory years 1993/94–1997/98

Hunt area	Year	Nr Hunters	M	(%)[c]	F	(%)[c]	Unknown	(%)[d]	Total harvest	Percent Estimated population[e]
NECCUA										
	1993/94	31	7	(88)	1	(12)	0		8	1.3
	1994/95	50	19	(95)	1	(5)	0		20	3.3
	1995/96	27	7	(58)	5	(42)	0		12	2.0
	1996/97	27	13	(93)	1	(7)	0		14	2.3
	1997/98	30	10	(83)	2	(17)	0		12	2.0
Remainder of Chichagof Island										
	1993/94	49	20	(67)	10	(33)	0		30	2.7
	1994/95	65	19	(63)	11	(37)	0		30	2.7
	1995/96	61	26	(72)	10	(28)	0		36	3.3
	1996/97	61	30	(77)	9	(23)	0		39	3.5
	1997/98	69	34	(87)	5	(13)	0		39	3.5
Baranof and Kruzof islands										
	1993/94	65	15	(88)	2	(12)	0		17	1.7
	1994/95	78	15	(79)	4	(21)	0		19	1.9
	1995/96	74	20	(67)	10	(33)	0		30	3.0
	1996/97	63	21	(91)	2	(9)	0		23	2.3
	1997/98	86	18	(67)	9	(33)	0		27	2.7
Baranof and Chichagof islands[f]										
	1993/94	14								
	1994/95	6								
	1995/96	9								
	1996/97	7								
	1997/98	12								
Admiralty Island										
	1993/94	133	25	(53)	22	(47)	0		47	2.6
	1994/95	154	30	(71)	12	(29)	0		42	2.3
	1995/96	126	36	(78)	10	(22)	0		46	2.6
	1996/97	133	40	(75)	13	(25)	0		53	2.9
	1997/98	147	45	(80)	11	(20)	0		56	3.1
Unit 4 Totals										
	1993/94	292	67	(66)	35	(34)	0		102	2.3
	1994/95	353	83	(75)	28	(25)	0		111	2.5
	1995/96	297	89	(72)	35	(28)	3		127	2.8
	1996/97	291	104	(81)	25	(19)	0		129	2.9
	1997/98	344	107	(80)	27	(20)	0		134	3.0

[a] Registration permit data.
[b] Bear sealing data.
[c] Percentage based on known sex bears.
[d] Percentage based on total bears.
[e] Estimated populations: NECCUA, 600 bears; remainder of Chichagof Island, 1100; Baranof and Kruzof islands, 1000 bears; Admiralty Island, 1800 bears; all Unit 4, 4500 bears.
[f] Unsuccessful hunters who indicated both Baranof and Chichagof islands as hunt locations.

Table 3 Unit 4 brown bear successful hunter residency, 1993–1994 through 1997–1998

Regulatory year	Local resident[a]	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total successful hunters
1993–94	15	(15)	18	(18)	69	(67)	102
1994–95	14	(12)	24	(22)	73	(66)	111
1995–96	18	(14)	23	(19)	83	(67)	124
1996–97	16	(12)	17	(13)	96	(75)	129
1997–98	13	(10)	30	(22)	91	(68)	134

[a] Resident of Unit 4.

Table 4 Unit 4 hunting effort by residency, by island, 1993/94–1997/98

Island	Season	Nr resident hunters	Nr nonresident hunters	Total hunters	Days hunted by residents	Days hunted by nonresidents	Nr days hunted	Nr bears killed	Days effort per bear
Admiralty									
	Fall 1993	29	19	48	148	119	267	13	21
	Spring 1994	54	31	85	304	200	504	34	15
	Fall 1994	33	13	46	165	84	249	7	36
	Spring 1995	70	38	108	349	237	586	35	17
	Fall 1995	30	7	37	112	35	147	10	15
	Spring 1996	53	36	89	204	200	404	36	11
	Fall 1996	23	19	42	106	79	185	13	14
	Spring 1997	56	35	91	195	189	384	40	10
	Fall 1997	26	14	40	140	80	220	10	22
	Spring 1998	64	43	107	283	251	534	46	12
Baranof									
	Fall 1993	22	15	37	70	90	160	8	20
	Spring 1994	19	9	28	65	58	123	9	14
	Fall 1994	24	5	29	100	17	117	4	29
	Spring 1995	31	18	49	108	114	222	15	15
	Fall 1995	29	9	38	85	36	121	14	9
	Spring 1996	15	21	36	42	143	185	16	12
	Fall 1996	16	7	23	63	46	109	6	18
	Spring 1997	23	17	40	81	73	154	17	9
	Fall 1997	20	10	30	111	54	165	5	33
	Spring 1998	31	25	56	104	146	250	22	11
Chichagof									
	Fall 1993	7	9	16	30	60	90	7	13
	Spring 1994	28	36	64	117	236	353	31	11
	Fall 1994	17	6	23	69	36	105	8	13
	Spring 1995	54	38	92	309	243	552	42	13
	Fall 1995	11	9	20	31	54	85	10	9
	Spring 1996	29	39	68	129	197	326	38	9
	Fall 1996	18	11	29	80	45	125	15	8
	Spring 1997	24	35	59	93	218	311	38	8
	Fall 1997	16	10	26	68	59	127	11	12
	Spring 1998	32	41	73	141	244	385	40	10

Table 4 Continued

Island	Season	Nr. resident hunters	Nr. nonresident hunters	Total hunters	Days hunted by residents	Days hunted by nonresidents	Nr. days hunted	Nr. bears killed	Days effort per bear
Baranof & Chichagof									
	Spring 1994	3	11	14	7	48	55		
	Spring 1995	4	2	6	21	13	34		
	Fall 1995	0	1	1	0	4	4		
	Spring 1996	3	5	8	18	16	34		
	Fall 1996	0	1	1	0	2	2		
	Spring 1997	4	2	6	15	17	32		
	Fall 1997	1	2	3	3	16	19		
	Spring 1998	3	6	9	8	66	74		
Unit 4 Totals									
	Fall 1993	58	43	101	248	269	517	28	18
	Spring 1994	104	87	191	493	542	1,035	74	14
	Fall 1994	74	24	98	334	137	471	19	25
	Spring 1995	159	96	255	787	607	1,394	92	15
	Fall 1995	70	26	96	228	129	357	34	11
	Spring 1996	100	101	201	393	556	949	90	11
	Fall 1996	57	38	95	249	172	421	34	12
	Spring 1997	107	89	196	384	497	881	95	9
	Fall 1997	63	36	99	322	209	531	26	20
	Spring 1998	130	115	245	536	707	1,243	108	12

Table 5 Unit 4 brown bear harvest chronology, 1993/94–1997/98[a]

Regulatory year	Fall harvest periods										
	9/11–9/20	9/21–9/30	10/1–10/10	10/11–10/20	10/21–10/31	11/1–11/10	11/11–11/20	11/21–11/31	12/1–12/10	12/11–12/20	12/21–12/31
1993/94	13	5	4	3	1	0	2	0	0	0	0
1994/95	8	8	1	0	0	1	0	0	0	1	0
1995/96	17	12	2	1	0	1	1	0	0	0	0
1996/97	15	9	3	1	3	1	2	0	0	0	0
1997/98	13	5	4	0	1	2	1	0	0	0	0

	Spring harvest periods						
	4/1–4/10	4/11–4/20	4/21–4/30	5/1–5/10	5/11–5/20	5/21–5/31	Total
1993/94	0	0	5	37	27	5	102
1994/95	0	1	2	36	43	10	111
1995/96	1	1	10	33	35	10	124
1996/97	0	0	14	32	39	10	129
1997/98	0	1	9	45	43	10	134

[a] Includes all hunts.

Table 6 Unit 4 brown bear harvest by transport method, 1993/94–1997/98 [a]

	Harvest			
Regulatory year	Airplane	Boat	Walked	Highway vehicle
1993/94	8	88	2	4
1994/95	9	97	2	3
1995/96	8	112	2	2
1996/97	7	120	1	1
1997/98	13	118	1	2

[a]Sealing certificate data and registration permit data often differ. Sealing certificate data were used.

LOCATION

GAME MANAGEMENT UNIT: 5 (5800 mi^2)

GEOGRAPHIC DESCRIPTION: Cape Fairweather to Icy Bay, Eastern Gulf Coast

BACKGROUND

Brown bears probably first occurred on the Yakutat and Malaspina Forelands following glacial retreat 300 to 500 years ago. Like many other wildlife species, brown bears gained access to the eastern gulf coast by moving from the Alaska Interior and Canada via the Alsek/Tatshenshini corridor.

Since 1961 when brown bears were first sealed in Alaska, 868 sport-killed bears have been sealed from Unit 5 (734 from 5A and 134 from 5B). Sixty-five percent of these bears were males, with 64% taken by nonresident hunters. An additional 58 bears have been taken in situations other than legal hunts in the same period.

A 1988 Superior Court decision that deregulated the guide industry caused an increase in guide activity. From 1980 through 1988 the average number of guided nonresident brown bear hunters per year in Unit 5 was 22. Since then, the number has climbed to an average of 26 per year.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Division of Wildlife Conservation is managing brown bears in Unit 5 to maintain a male to female harvest ratio of at least 3:2 and an average age of harvested males of at least 6.5 years. We intend to establish long-term objectives in a regional strategic brown bear management plan.

METHODS

Alaska Department and Fish and Game and Division of Fish and Wildlife Protection staff gathered most data from the sealing of brown bears. State game regulations require that brown bear hides and skulls are sealed within 30 days of harvest. Skulls are measured and a pre-molar tooth is extracted for age determination. Additional information is collected from hunters, such as harvest date and location, transportation method, guide information, and number of days of effort. Hunters also provide anecdotal information from their observations in the field.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population information is not available for Unit 5 brown bears. Data gathered from sealing certificates, incidental observations, and hunter interviews indicate no notable changes in the population. However, the highest kill on record occurred in 1991 when 41 brown bears were harvested, and the harvest in 1992 was only 1 animal less. Since that time, the harvest has ranged from 27 to 31 bears in all years except 1996 when 38 bears were taken. Although the average age

and skull size of males decreased slightly during the years of higher harvest, those measures have returned to or have exceeded long-term averages.

MORTALITY

Harvest

Season and Bag Limit:	Resident and nonresident hunters	
Unit 5	Sep 1–May 31	1 bear every 4 regulatory years

Board of Game Actions and Emergency Orders. No board actions were taken and no emergency orders were issued during this reporting period. A federal ceremonial brown bear hunt was instituted that allows Yakutat residents to obtain a permit to take 1 bear per year, with no requirements for sealing or for obtaining a metal locking tag. To date, no bears have been taken under this system.

Hunter Harvest. Unit 5 brown bear harvests have stabilized after decreasing from all-time highs in the early 1990s. Before that, bear harvests had constantly increased since sealing began. The average kill from 1971–80 was 21 bears, with a range of 13–28 bears. The 1981–90 mean harvest was 30 animals, ranging from 23–33 bears. Since 1990, the annual average kill has been 34 bears. The mean age for male bears increased between the 1970s (5.8 years) and the 1980s (7.0 years) but has fallen off in the 1990s ($\bar{x}$ = 6.1 years). Average male skull size (22.8 inches) has leveled off in the 1990s, after increasing more dramatically between the two earlier decades (20.1 inches to 22.6 inches from the 1970s to the 1980s). See Table 1 for a summary of Unit 5 brown bear harvests since 1989. During the 1996 season 23 males, 14 females, and 1 bear of unknown sex were reported taken (Table 1). Females composed 37% of the harvest, which is higher than the mean of 28% since 1990. Average male skull size of 23.1 inches was slightly higher than the previous five-year average of 22.5 inches. The average age of male bears (5.4 years) was more than a full year below our management objective.

In 1997, 18 male and 9 female brown bears were killed by hunters (Table 1). Females composed 33% of the harvest. Mean male skull size was 23.4 inches, and the average age of male bears, having rebounded from the last report period, was 6.1 years, which is .4 inches below the management objective. The reasons for the oscillations in skull sizes and ages of harvested bears over the past few years are unknown. Since there is not a registration permit required in Unit 5, we cannot measure variations in hunter effort or success.

Hunter Residency and Success. From 1991 through 1995 nonresident hunters accounted for an average of 77% of the Unit 5 brown bear harvest (Table 3). This trend continued during the current reporting period with 77% of the harvest going to nonresidents.

Harvest Chronology. From 1991–95 the average proportion of brown bears taken in the spring was 50% (Table 2). However, in 1996 and 1997, only 32% and 33% of the bears were killed in the spring, respectively.

Transport Methods. Transportation types used in successful brown bear hunts in 1996 included aircraft (79%), boats (18%), and highway vehicles (3%). In 1997, aircraft were used in 63% of the successful brown bear hunts, the use of boats increased to 26%, and ORV's accounted for 4%.

Other Mortality

This category refers to bears killed in defense of life or property, illegal kills, road kills, and nuisance bears. The Yakutat landfill is the main area of concern regarding these types of mortality. The landfill attracts dozens of bears throughout the year, and some of these brown bears are eventually killed.

HABITAT

Assessment and Enhancement

We did not conduct any habitat assessment studies or enhancement projects relating to brown bears during this report period. Changes to the Situk River Management Plan currently being revised by the Forest Service may affect brown bear use along the Situk River corridor and commercial tourism on the river.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

One area of concern that we are trying to address is the Yakutat landfill. The division is working with the community of Yakutat and the Department of Environmental Conservation (DEC) to remedy landfill problems and curtail brown bear attractants

CONCLUSIONS AND RECOMMENDATIONS

Unit 5 male brown bear age objectives were not met in either year of this report period. Bears were harvested in a male to female ratio of 3.3:2 and 4:2 in 1996 and 1997, respectively, exceeding the minimum 3:2 male to female harvest ratio established in the management objectives. In 4 of the past 5 years, the Unit 5 brown bear harvest was lower than the all-time highs seen in 1991 and 1992. With no population information available, we cannot determine impacts to the local brown bear population from those years of high harvests. Although we are concerned about the trend in harvest data showing a slight increase in the harvest of younger male bears, we do not consider this detrimental to the population. We will continue to analyze the age and skull sizes of harvested bears and closely monitor the harvest of breeding-aged female bears. Implementing a registration permit would allow us to assess hunter effort and success.

When black or brown bears use areas near residences in Yakutat, community residents view them as pests. The Yakutat dump has been an attractant to bears for decades and continues to be a problem, with several bears consistently present. We should continue to emphasize to local residents the importance of properly managing garbage and work with ADEC to eliminate this fatal attractant to bears.

PREPARED BY:
Neil Barten
Wildlife Biologist II

APPROVED BY:
Bruce Dinneford
Management Coordinator

Table 1 Unit 5 brown bear harvest, age, skull sizes, and effort, 1989–1997

Regulatory Year	Harvest				Mean Age			Mean Skull Size		Avg Days/Kill	
	M	F	Unk	Total	M	F	Total	M	F	M	F
1989	18	10	1	29	6.6	4.0	5.7	22.8	20.0	3.6	3.6
1990	25	8	2	35	7.9	4.3	6.9	23.2	20.3	5.0	4.0
1991	33	8	0	41	5.3	4.9	5.3	22.4	20.3	5.4	4.3
1992	28	12	0	40	5.0	5.6	5.2	22.2	20.3	4.3	3.8
1993	19	11	0	30	6.7	6.7	6.7	21.3	21.2	3.2	5.6
1994	22	6	0	28	5.5	4.2	5.2	23.0	20.6	4.6	5.7
1995	24	7	0	31	6.7	8.4	7.1	23.5	22.5	4.2	4.0
1996	23	14	1	38	5.4	3.8	4.8	23.1	20.8	4.7	5.6
1997	18	9	0	27	6.1	7.0	6.4	23.4	20.6	4.3	4.3
Means											
Report Period	20.5	11.5	0.5	32.5	5.8	5.0	5.5	23.2	20.7	4.6	4.8
1989–95	24.1	8.9	0.4	33.4	6.2	5.5	6.0	22.8	20.7	4.4	4.4

Table 2 Unit 5 brown bear harvest chronology, 1989–1997

Regulatory Year	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
1989	0	0	10	3	1	0	0	0	0	5	10	0	29
1990	0	0	15	2	1	0	0	0	0	3	14	0	35
1991	0	0	21	2	0	0	0	0	0	2	16	0	41
1992	0	0	21	5	0	0	0	0	0	3	11	0	40
1993	0	0	7	3	1	1	0	0	0	7	11	0	30
1994	0	0	9	2	0	0	1	0	0	6	10	0	28
1995	0	0	12	1	0	0	0	2	0	7	9	0	31
1996	0	0	21	6	0	0	0	0	0	4	8	0	39
1997	0	0	11	7	0	0	0	0	0	4	5	0	27

Table 3 Unit 5 brown bear hunter residency, 1991–1997

Regulatory year		Local resident	(%)	Nonlocal resident	(%)	Nonresident	(%)
1991	Fall	3	(7)	3	(7)	17	(41)
	Spring	2	(5)	0	(0)	16	(39)
	Total	5	(12)	3	(7)	33	(80)
1992	Fall	2	(5)	4	(10)	20	(50)
	Spring	1	(3)	4	(10)	9	(23)
	Total	3	(8)	8	(20)	29	(73)
1993	Fall	1	(3)	3	(1)	8	(27)
	Spring	0	(0)	5	(16)	13	(43)
	Total	1	(3)	8	(27)	21	(70)
1994	Fall	1	(4)	1	(4)	9	(32)
	Spring	2	(7)	0	(0)	15	(54)
	Total	3	(11)	1	(4)	24	(86)
1995	Fall	1	(3)	0	(0)	12	(39)
	Spring	2	(6)	3	(10)	13	(42)
	Total	3	(10)	3	(10)	25	(81)
1996	Fall	1	(3)	6	(16)	19	(50)
	Spring	1	(3)	2	(5)	9	(24)
	Total	2	(5)	8	(21)	28	(74)
1997	Fall	1	(4)	4	(15)	13	(48)
	Spring	0	(0)	0	(0)	9	(33)
	Total	1	(4)	4	(15)	22	(81)

Table 4 Unit 5 transport modes used by successful brown bear hunters, 1991–1997

Regulatory year	Plane	(%)	Boat	(%)	ORV/ wheeler	(%)	Highway vehicle	(%)	Foot	(%)	Other	(%)
1991	22	(54)	9	(22)	4	(10)	0	(0)	2	(5)	4	(10)
1992	22	(55)	10	(25)	0	(0)	4	(10)	3	(8)	1	(3)
1993	19	(63)	7	(23)	0	(0)	0	(0)	4	(13)	0	(0)
1994	16	(57)	6	(21)	0	(0)	1	(4)	4	(14)	1	(4)
1995	23	(74)	4	(13)	0	(0)	2	(6)	1	(3)	1	(3)
1996	30	(79)	7	(18)	0	(0)	1	(3)	0	(0)	0	(0)
1997	17	(63)	7	(26)	1	(4)	2	(7)	0	(0)	0	(0)

LOCATION

GAME MANAGEMENT UNIT: 6 (10,140 mi^2)

GEOGRAPHIC DESCRIPTION: Prince William Sound and North Gulf Coast

BACKGROUND

Brown bears inhabit most of Unit 6, with the exception of Middleton Island and small islands in Unit 6D. Brown bears are common on the mainland east of Columbia Glacier to Icy Bay and on Hinchinbrook, Hawkins, and Kayak Islands. The population of bears on Montague Island is recovering from excessive harvest that occurred during the 1970s and early 1980s. Brown bears are rare on the mainland in western Unit 6D. Distribution in Unit 6D appears unchanged from that observed by Heller (1910).

Harvest is monitored by mandatory sealing, which began in 1961. Total annual harvest increased substantially in the late 1980s and continued at a relatively high level through 1992–93. Average annual kill during regulatory years 1961–62 through 1986–87 was 32 bears (range = 14–63). During 1987–88 through 1991–92, the average yearly harvest was 50 bears (range = 40–60). Most of the increased harvest was in Unit 6D, probably resulting in a population decline. From 1992–93 through 1996–97, the average harvest in Unit 6 was 32 bears (range = 44–22).

The Board of Game changed the bag limit for brown bears in Units 6A, 6B, and 6C from 1 bear/4 years to 1 bear/year beginning in 1997 for resident hunters only. This was in response to low moose calf survival in Unit 6B and increasing bear numbers in these units.

Logging threatens brown bear abundance and distribution in Unit 6A. Extensive clearcutting of old-growth timber on private and state land is in progress between Icy Bay and Cape Yakataga. Old-growth stands are important habitat for coastal bears (Schoen 1990, Schoen and Beier 1990, Schoen et al. 1986). Logging also provides access roads, increases human activity, and stimulates developments that increase bear-human interactions that lead to increased brown bear mortality (McLellan and Shackleton 1988, Smith and VanDaele 1989). The proposed Carbon Mountain logging road would increase human access to currently remote backcountry in Units 6A and 6B. The Exxon Valdez Oil Spill (EVOS) Trustee Council has recently acquired or protected most lands scheduled for timber harvest in Unit 6D, thus removing the threat of continued, large-scale habitat loss in Prince William Sound (PWS).

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Maintain a brown bear population capable of sustaining a minimum annual harvest of 35 bears to include a minimum of 60% males, with a minimum average skull size of 23 inches.

METHODS

Griese (1991) established baseline estimates of brown bear numbers and density in Unit 6. Bear habitat was defined as nonglaciated land below 3000 ft elevation, quantified by harvest areas (major drainages or other gross geographical characteristic), and summed for each unit. Griese (1991) estimated bear density and numbers within harvest areas using den and track surveys and local knowledge. Densities were extrapolated to entire harvest areas. Bear populations for each harvest area are updated annually, based on the trend and harvest from the previous season, incidental observations, and input from local hunters and guides. Nowlin (1995) constructed a spreadsheet to update densities and calculate annual allowable harvest for each of 11 harvest areas.

Annual allowable harvest (AAH) of all bears was estimated as 5% of the total population (Griese 1991, Nowlin 1993). AAH of females >2 years old was estimated as 2% of the population. Because reproduction and survival data were not available for Unit 6, this rate was arbitrarily set a level slightly more conservative than the 5.7% and 2.5% recommended for ideal conditions (Miller 1988, 1990).

I estimated the total harvest by adding reported harvest and estimated illegal kill. The reported harvest included all bears that were sealed after being taken by hunters or killed for other reasons, such as defense of life or property. Information collected included sex, age, and skull size of the bear and date and location of kill, hunter residency, number of days hunted, and method of transportation. Unsuccessful hunters were not required to report. I estimated the illegal kill based on previous years estimates (Nowlin 1997).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The estimated brown bear population in Unit 6 was 840 bears with an increasing trend (Table 1). The greatest numbers were in Units 6A (≅290) and 6D (≅295), followed by Units 6B (≅130) and 6C (≅120). In Unit 6D the population declined during 1991 to about 90 because of excessive harvests. Lower harvest in Unit 6D during the past 5 years probably resulted in an increase in population. However, during 1997–98 the annual allowable harvest in 6D was again exceeded; most of the brown bears taken were in the Rude River-Ellamar area in eastern PWS (Table 1).

Montague Island in Unit 6D had a slowly increasing population of about 50 bears (Table 1). The island was closed to hunting in 1994. It is particularly sensitive to overharvest because it is isolated from the mainland and because the number of bears is low. Historically, it probably had much higher numbers. However, overharvest that began in the 1970s reduced the population (Griese 1990) and threatened its viability. Inbreeding in small, isolated populations, such as Montague Island, probably reduces genetic variability and may increase the danger of extinction (Mills and Smouse 1994, Randi et al. 1994).

Density estimates for Unit 6 compared favorably to Miller's (1993) estimates from elsewhere in south coastal Alaska. Hinchinbrook Island was within a high-density range (>175

bears/1000 km^2) that included Kodiak Island, much of the Alaska Peninsula, and parts of Southeast Alaska. Montague Island, eastern PWS, and the north gulf coast had midrange density (40–175 bears/1000 km^2), consistent with contiguous coastal habitat to the southeast and with the northern Alaska Peninsula. Western PWS was low density (<40 bears/1000 km^2), similar to the adjacent Kenai Peninsula.

MORTALITY

Harvest

Season and Bag Limit. The hunting season for all hunters in Units 6A, 6B, and 6C was 1 September to 31 May. The Unit 6D season, except Montague Island, was 15 October to 15 May for all hunters. Before 1997–98 the bag limit was 1 bear every 4 regulatory years. This was changed to 1 bear every regulatory year for resident hunters in Units 6A, 6B, and 6C in 1997, and the season for Unit 6D was changed to 15 October to 25 May. Taking cubs (bears ≤ 2 years old) or females accompanied by cubs was prohibited. There was no open season on Montague Island.

Hunter Harvest. Reported kill during 1996–97 and 1997–98 for Unit 6 was 30 and 54, respectively (Table 1). Most of the large increase in harvest occurred in Units 6D (11 and 26 bears taken each regulatory year) and 6A (11 and 16 bears taken per year). Seventeen of the bears harvested in Unit 6D came from the Rude River-Ellamar area, exceeding the estimated AAH by 13 bears (Table 1).

During 1996–97 and 1997–98 males were 62% and 72%, respectively, of the reported kill by hunters (Table 2), and mean skull sizes among males were 23 inches during both years (Table 3). These were similar to most values during the past 5 years. I compared 5-year averages of skull size and age of male bears killed in Unit 6D between the periods 1983–1987 and 1993–1997. Although average skull size decreased by 0.6 in., a Mann-Whitney U Test indicated no significant change in skull size ($P = 0.12$) or age ($P = 0.83$). In addition, the percent of males in the harvest in Unit 6D increased (although not with statistical significance) from the early period to 1997.

Reported kill of all bears was ≤ AAH in 10 of 11 harvest areas during 1996–97 and 7 of 11 during 1997–98 (Table 1). Harvest exceeded AAH by only 1 or 2 bears in each of the other areas, except for the Rude River-Ellamar area in Unit 6D. Reported kill of females >2 years old was ≤ AAH in all harvest areas during both years.

The change in bag limit had apparently little effect on harvest in Units 6B and 6C where hunters took an average number of bears. However, both the bear harvest and number of local resident hunters increased by about 5 in Unit 6A during 1997–98 (Tables 1 and 4), indicating the regulation affected that subunit.

Hunter Residency. Nonresidents harvested most of the bears in Unit 6 during 1996–97 (63%) and 1997–98 (55%) (Table 4). In Unit 6C local and nonlocal resident hunters took the highest proportion of the harvest. This occurred because the area was more accessible by road or boat and attracted more resident hunters. Before this reporting period, resident hunters had taken

most of the harvest in Unit 6D, but now nonresidents harvest more brown bears (Table 4). This change indicates increased guiding activity (or success) in PWS. Nearly 40% of the bears taken in Unit 6D during 1997–98 were through 1 guide.

Harvest Chronology. Most bears were taken in Unit 6 in October (30%) and September (26%) during the 1996–97 season (Table 5), which was somewhat unusual. The 1997–98 season had a more normal pattern with 51% of the harvest in May, 25% in September, and 26% in October.

Transport Methods. Airplanes were the most important method of transportation unitwide (Table 6). In Unit 6C, highway vehicles were also important because of road access. In Unit 6D, boats and aircraft were important because of the relatively sheltered waters of PWS. These patterns were typical of the past 5 years.

Other Mortality

Nonhunting and estimated illegal kill totaled 11 and 12 bears in 1996–97 and 1997–98, respectively (Table 2). This was slightly higher than normal but anticipated with a growing bear population.

Nonregulatory Management Problems/Needs

As logging increases in Unit 6A, brown bear habitat quality will decline, access will improve, and nonhunting mortality will probably increase.

CONCLUSIONS AND RECOMMENDATIONS

We achieved our management objectives for brown bears in Unit 6. We maintained a population capable of sustaining a harvest of 35 bears and had a minimum of 60% males in the kill with an average skull size of at least 23 inches.

Brown bear numbers were stable or increasing. Management strategies based on 5% AAH were appropriate and should continue. Lower harvest in Unit 6D through 1996–97 probably allowed the population to increase. However, because of excessive harvest during 1997–98, close monitoring during the next several seasons is necessary. Montague Island should remain closed until the population increases to at least 80 bears.

We will continue to monitor the effect of the 1-bear/year bag limit. The bag limit was changed without scientific evidence that brown bears were contributing significantly to moose calf mortality, although bears have been observed feeding on calves. Therefore, I recommend a cooperative effort between the Department and U.S. Forest Service, Cordova Ranger District to study causes of moose calf mortality in Unit 6B.

Logged areas unitwide should be given special attention. Bear harvests should be closely monitored, particularly nonhunting and illegal kills. Contractors should be monitored to assure operator compliance with guidelines for handling garbage and other attractants and education/enforcement actions taken when necessary.

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PREPARED BY:

Dave Crowley
Wildlife Biologist

SUBMITTED BY:

Michael G. McDonald
Wildlife Biologist

Table 1 Unit 6 brown bear estimated population, annual allowable harvest and reported harvest, 1993–97

Unit	Area	Regulatory year	Density (bears/ 1000 km^2)	Nr. bears	Annual allowable harvest (all bears)	Reported harvest (all bears)	Annual allowable harvest (F>2 yr old)	Reported harvest (F>2 yr old)
6A	Icy Bay-Cape Suckling	1993/94	88	163	8	2	3	0
		1994/95	90	168	8	7	3	2
		1995/96	93	172	9	7	3	0
		1996/97	95	176	9	7	4	3
		1997/98	98	181	9	10	4	3
	Cape Suckling-Katalla	1993/94	63	87	4	4	2	1
		1994/95	65	90	5	3	2	0
		1995/96	67	93	5	6	2	1
		1996/97	69	96	5	4	2	1
		1997/98	72	99	5	5	2	1
	Kayak Island	1993/94	78	7	0	0	0	0
		1994/95	78	7	0	0	0	0
		1995/96	78	7	0	0	0	0
		1996/97	78	7	0	0	0	0
		1997/98	78	7	0	1	0	0
6A Total		1993/94	77	257	13	6	5	1
		1994/95	80	264	13	10	5	2
		1995/96	82	271	14	13	5	1
		1996/97	84	278	14	11	6	4
		1997/98	87	287	14	16	6	4

Table 1 Continued

Unit	Area	Regulatory year	Density (bears/ 1000 km^2)	Nr. bears	Annual allowable harvest (all bears)	Reported harvest (all bears)	Annual allowable harvest (F>2 yr old)	Reported harvest (F>2 yr old)
6B		1993/94	113	122	6	1	2	1
		1994/95	117	126	6	6	3	2
		1995/96	120	129	6	5	3	2
		1996/97	124	134	7	3	3	1
		1997/98	129	139	7	6	3	0
6C		1993/94	95	106	5	0	2	0
		1994/95	98	109	5	6	2	1
		1995/96	101	112	6	5	2	3
		1996/97	103	115	6	5	2	1
		1997/98	108	120	6	6	2	1
6D	Rude River-Ellamar	1993/94	63	78	4	10	2	3
		1994/95	63	78	4	3	2	1
		1995/96	63	78	4	6	2	0
		1996/97	63	78	4	4	2	1
		1997/98	64	80	4	17	2	2
	Valdez Arm	1993/94	39	36	2	0	1	0
		1994/95	39	36	2	3	1	1
		1995/96	39	36	2	1	1	0
		1996/97	39	36	2	1	1	0
		1997/98	39	36	2	2	1	0

Table 1 Continued

Unit	Area	Regulatory year	Density (bears/ 1000 km^2)	Nr. bears	Annual allowable harvest (all bears)	Reported harvest (all bears)	Annual allowable harvest (F>2 yr old)	Reported harvest (F>2 yr old)
6D	Western PWS	1993/94		17	1	0	0	0
		1994/95		17	1	0	0	0
		1995/96		17	1	0	0	0
		1996/97		17	1	0	0	0
		1997/98		17	1	0	0	0
	Hinchinbrook Island	1993/94	224	90	4	5	2	0
		1994/95	224	90	4	5	2	1
		1995/96	224	90	4	4	2	1
		1996/97	224	90	4	5	2	2
		1997/98	232	93	5	6	2	2
	Hawkins Island Island	1993/94	89	15	1	0	0	0
		1994/95	89	15	1	0	0	0
		1995/96	98	17	1	0	0	0
		1996/97	104	18	1	0	0	0
		1997/98	110	19	1	1	0	0
	Montague Island	1993/94	54	41	2	0	1	0
		1994/95	57	43	2	1	1	0
		1995/96	60	45	2	0	1	0
		1996/97	63	48	2	0	1	0
		1997/98	68	52	3	0	1	0

Table 1 Continued

Unit	Area	Regulatory year	Density (bears/ 1000 km^2)	Nr. bears	Annual allowable harvest (all bears)	Reported harvest (all bears)	Annual allowable harvest (F>2 yr old)	Reported harvest (F>2 yr old)
6D Total		1993/94	-	276	14	15	6	3
		1994/95	-	278	14	12	6	3
		1995/96	-	282	14	11	6	1
		1996/97	-	285	14	11	6	3
		1997/98	-	295	15	26	6	4
Unit 6 Total		1993/94	-	760	38	22	15	5
		1994/95	-	777	39	34	16	8
		1995/96	-	794	40	35	16	7
		1996/97	-	812	41	30	16	9
		1997/98	-	840	42	54	17	11

Table 2 Unit 6 brown bear harvest, 1993–97

Unit	Regulatory year	Reported: Hunter kill M	F	(%)	Unk.	Total	Reported: Nonhunting M	F	Unk.	Estimated kill	Total estimated kill M	(%)	F	(%)	Unk.	Total
6A	1993/94															
	Fall 93	1	1	(50)	0	2	0	0	0	0	1	(50)	1	(50)	0	2
	Spring 94	2	1	(33)	0	3	0	1	0	1	2	(50)	2	(50)	1	5
	Total	3	2	(40)	0	5	0	1	0	1	3	(50)	3	(50)	1	7
	1994/95															
	Fall 94	2	2	(50)	1	5	0	2	0	1	2	(33)	4	(67)	2	8
	Spring 95	3	0	(0)	0	3	0	0	0	0	3	(100)	0	(0)	0	3
	Total	5	2	(29)	1	8	0	2	0	1	5	(56)	4	(44)	2	11
	1995/96															
	Fall 95	5	2	(29)	0	7	0	0	0	1	5	(71)	2	(29)	1	8
	Spring 96	6	0	(0)	0	6	0	0	0	1	6	(100)	0	(0)	1	7
	Total	11	2	(15)	0	13	0	0	0	2	11	(85)	2	(15)	2	15
	1996/97															
	Fall 96	1	5	(83)	0	6	0	0	0	1	1	(17)	5	(83)	1	7
	Spring 97	5	0	(0)	0	5	0	0	0	1	5	(100)	0	(0)	1	6
	Total	6	5	(45)	0	11	0	0	0	2	6	(55)	5	(45)	2	13
	1997/98															
	Fall 97	7	6	(46)	0	13	1	0	0	1	8	(57)	6	(43)	1	15
	Spring 98	2	0	(0)	0	2	0	0	0	1	2	(100)	0	(0)	1	3
	Total	9	6	(40)	0	15	1	0	0	2	10	(63)	6	(38)	2	18

Table 2 Continued

Unit	Regulatory year	Reported								Estimated						
		Hunter kill					Nonhunting				Total estimated kill					
		M	F	(%)	Unk.	Total	M	F	Unk.	kill	M	(%)	F	(%)	Unk.	Total
6B	1993/94															
	Fall 93	0	0	(0)	0	0	0	0	0	0	0	(0)	0	(0)	0	0
	Spring 94	0	1	(100)	0	1	0	0	0	0	0	(0)	1	(100)	0	1
	Total	0	1	(100)	0	1	0	0	0	0	0	(0)	1	(100)	0	1
	1994/95															
	Fall 94	0	0	(0)	0	0	0	0	0	1	0	(0)	0	(0)	1	1
	Spring 95	4	2	(33)	0	6	0	0	0	0	4	(67)	2	(33)	0	6
	Total	4	2	(33)	0	6	0	0	0	1	4	(67)	2	(33)	1	7
	1995/96															
	Fall 95	1	2	(67)	0	3	0	0	0	1	1	(33)	2	(67)	1	4
	Spring 96	2	1	(33)	0	3	0	0	0	1	2	(67)	1	(33)	1	4
	Total	3	3	(50)	0	6	0	0	0	2	3	(50)	3	(50)	2	8
	1996/97															
	Fall 96	2	1	(33)	0	3	0	0	0	1	2	(67)	1	(33)	1	4
	Spring 97	0	0	(0)	0	0	0	0	0	1	0	(0)	0	(0)	1	1
	Total	2	1	(33)	0	3	0	0	0	2	2	(67)	1	(33)	2	5
	1997/98															
	Fall 97	2	1	(33)	0	3	0	0	0	1	2	(67)	1	(33)	1	4
	Spring 98	3	0	(0)	0	3	0	0	0	1	3	(100)	0	(0)	1	4
	Total	5	1	(17)	0	6	0	0	0	2	5	(83)	1	(17)	2	8

Table 2 Continued

Unit	Regulatory year	Reported								Estimated	Total estimated kill					
		Hunter kill					Nonhunting									
		M	F	(%)	Unk.	Total	M	F	Unk.	kill	M	(%)	F	(%)	Unk.	Total
6C	1993/94															
	Fall 93	0	0	(0)	0	0	0	0	0	1	0	(0)	0	(0)	1	1
	Spring 94	0	0	(0)	0	0	0	0	0	0	0	(0)	0	(0)	0	0
	Total	0	0	(0)	0	0	0	0	0	1	0	(0)	0	(0)	1	1
	1994/95															
	Fall 94	2	3	(60)	0	5	0	0	0	1	2	(40)	3	(60)	1	6
	Spring 95	1	0	(0)	0	1	0	0	0	0	1	(100)	0	(0)	0	1
	Total	3	3	(50)	0	6	0	0	0	1	3	(50)	3	(50)	1	7
	1995/96															
	Fall 95	1	2	(67)	0	3	0	0	0	1	1	(33)	2	(67)	1	4
	Spring 96	1	1	(50)	0	2	0	0	0	1	1	(50)	1	(50)	1	3
	Total	2	3	(60)	0	5	0	0	0	2	2	(40)	3	(60)	2	7
	1996/97															
	Fall 96	2	0	(0)	0	2	1	0	0	1	3	(100)	0	(0)	1	4
	Spring 97	2	1	(33)	0	3	0	0	0	1	2	(67)	1	(33)	1	4
	Total	4	1	(20)	0	5	1	0	0	2	5	(83)	1	(17)	2	8
	1997/98															
	Fall 97	3	1	(25)	0	4	0	1	0	1	3	(60)	2	(40)	1	6
	Spring 98	1	0	(0)	0	1	0	0	0	1	1	(100)	0	(0)	1	2
	Total	4	1	(20)	0	5	0	1	0	2	4	(67)	2	(33)	2	8

Table 2 Continued

Unit	Regulatory year	Reported								Estimated						
		Hunter kill					Nonhunting				Total estimated kill					
		M	F	(%)	Unk.	Total	M	F	Unk.	kill	M	(%)	F	(%)	Unk.	Total
6D	1993/94															
	Fall 93	5	1	(17)	0	6	0	0	0	2	5	(83)	1	(17)	2	8
	Spring 94	7	2	(22)	0	9	0	0	0	1	7	(78)	2	(22)	1	10
	Total	12	3	(20)	0	15	0	0	0	3	12	(80)	3	(20)	3	18
	1994/95															
	Fall 94	1	1	(50)	0	2	1	1	0	3	2	(50)	2	(50)	3	7
	Spring 95	3	1	(25)	0	4	2	1	1	1	5	(71)	2	(29)	2	9
	Total	4	2	(33)	0	6	3	2	1	4	7	(64)	4	(36)	5	16
	1995/96															
	Fall 95	2	0	(0)	0	2	0	0	0	1	2	(100)	0	(0)	1	3
	Spring 96	7	2	(22)	0	9	0	0	0	2	7	(78)	2	(22)	2	11
	Total	9	2	(18)	0	11	0	0	0	3	9	(82)	2	(18)	3	14
	1996/97															
	Fall 96	5	3	(38)	0	8	0	0	0	2	5	(63)	3	(38)	2	10
	Spring 97	1	1	(50)	0	2	1	0	0	1	2	(67)	1	(33)	1	4
	Total	6	4	(40)	0	10	1	0	0	3	7	(64)	4	(36)	3	14
	1997/98															
	Fall 97	2	2	(50)	0	4	3	0	0	1	5	(71)	2	(29)	1	8
	Spring 98	15	4	(21)	0	19	0	0	0	1	15	(79)	4	(21)	1	20
	Total	17	6	(26)	0	23	0	0	0	2	20	(77)	6	(23)	2	28

Table 2 Continued

Unit	Regulatory year	Reported								Estimated	Total estimated kill					
		Hunter kill					Nonhunting									
		M	F	(%)	Unk.	Total	M	F	Unk.	kill	M	(%)	F	(%)	Unk.	Total
Unit 6 Total	1993/94															
	Fall 93	6	2	(25)	0	8	0	0	0	3	6	(75)	2	(25)	3	11
	Spring 94	9	4	(31)	0	13	0	1	0	2	9	(64)	5	(36)	2	16
	Total	15	6	(29)	0	21	0	1	0	5	15	(68)	7	(32)	5	27
	1994/95															
	Fall 94	5	6	(55)	1	12	1	3	0	6	6	(40)	9	(60)	7	22
	Spring 95	11	3	(21)	0	14	2	1	1	1	13	(76)	4	(24)	2	19
	Total	16	9	(36)	1	26	3	4	1	7	19	(59)	13	(41)	9	41
	1995/96															
	Fall 95	9	6	(40)	0	15	0	0	0	4	9	(60)	6	(40)	4	19
	Spring 96	16	4	(20)	0	20	0	0	0	5	16	(80)	4	(20)	5	25
	Total	25	10	(29)	0	35	0	0	0	9	25	(71)	10	(29)	9	44
	1996/97															
	Fall 96	10	9	(47)	0	19	1	0	0	5	11	(55)	9	(45)	5	25
	Spring 97	8	2	(20)	0	10	1	0	0	4	9	(82)	2	(18)	4	15
	Total	18	11	(38)	0	29	2	0	0	9	20	(65)	11	(35)	9	40
	1997/98															
	Fall 97	14	10	(42)	0	24	4	1	0	4	18	(62)	11	(38)	4	33
	Spring 98	21	4	(16)	0	25	0	0	0	4	21	(84)	4	(16)	4	29
	Total	35	14	(29)	0	49	4	1	0	8	39	(72)	15	(28)	8	62

Table 3 Unit 6 brown bear mean skull size and age, 1993–97

		Males				Females			
Unit	Year	Skull size	*n*	Age	*n*	Skull size	*n*	Age	*n*
6A	1993/94	21	3	3	2	21	2	5	2
	1994/95	24	5	6	5	23	2	15	2
	1995/96	24	11	6	10	22	2	4	2
	1996/97	23	6	6	6	22	5	4	5
	1997/98	24	9	6	9	21	6	6	6
6B	1993/94	-	0	-	0	23	1	15	1
	1994/95	24	4	7	4	23	1	7	2
	1995/96	24	2	4	2	21	3	4	3
	1996/97	22	2	3	2	23	1	15	1
	1997/98	23	5	4	5	19	1	2	1
6C	1993/94	-	0	-	0	-	0	-	0
	1994/95	24	2	4	3	21	3	7	3
	1995/96	21	2	2	2	21	3	6	3
	1996/97	25	3	7	3	22	1	5	1
	1997/98	25	4	5	4	21	1	2	1
6D	1993/94	24	11	10	12	21	3	7	3
	1994/95	22	4	6	4	23	2	10	2
	1995/96	23	9	6	9	21	2	7	2
	1996/97	22	5	5	5	20	3	7	4
	1997/98	22	17	5	17	21	5	8	5
Unit 6	1993/94	24	14	9	14	22	6	8	6
Total	1994/95	24	15	6	16	22	8	10	9
	1995/96	23	25	6	23	21	10	5	10
	1996/97	23	16	5	16	21	10	6	11
	1997/98	23	35	5	35	21	13	6	13

Table 4 Unit 6 brown bear successful hunter residency, 1993–97

Unit	Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Residency unknown	(%)	Total Successful hunters
6A	1993/94	0	(0)	0	(0)	4	(80)	1	(20)	5
	1994/95	0	(0)	1	(13)	7	(88)	0	(0)	8
	1995/96	1	(9)	0	(0)	10	(91)	0	(0)	11
	1996/97	0	(0)	0	(0)	11	(100)	0	(0)	11
	1997/98	5	(33)	1	(7)	9	(60)	0	(0)	15
6B	1993/94	0	(0)	0	(0)	1	(100)	0	(0)	1
	1994/95	0	(0)	1	(17)	5	(83)	0	(0)	6
	1995/96	2	(40)	1	(20)	2	(40)	0	(0)	5
	1996/97	1	(33)	2	(67)	0	(0)	0	(0)	3
	1997/98	2	(33)	2	(33)	2	(33)	0	(0)	6
6C	1993/94	0	(0)	0	(0)	0	(0)	0	(0)	0
	1994/95	2	(33)	2	(33)	2	(33)	0	(0)	6
	1995/96	3	(60)	0	(0)	2	(40)	0	(0)	5
	1996/97	2	(40)	2	(40)	1	(20)	0	(0)	5
	1997/98	4	(80)	0	(0)	1	(20)	0	(0)	5
6D	1993/94	3	(20)	7	(47)	5	(33)	0	(0)	15
	1994/95	1	(17)	4	(67)	1	(17)	0	(0)	6
	1995/96	2	(18)	5	(45)	4	(36)	0	(0)	11
	1996/97	1	(10)	3	(30)	5	(50)	1	(10)	10
	1997/98	4	(17)	4	(17)	15	(65)	0	(4)	23
Unit 6 Total	1993/94	3	(14)	7	(33)	11	(52)	0	(0)	21
	1994/95	3	(12)	8	(31)	15	(58)	0	(0)	26
	1995/96	8	(23)	6	(17)	18	(60)	0	(0)	35
	1996/97	4	(15)	6	(22)	17	(63)	0	(0)	29
	1997/98	15	(31)	7	(14)	27	(55)	0	(0)	49

Table 5 Unit 6 brown bear harvest chronology by percent, 1993–97

Unit	Regulatory year	Harvest periods: September 1–15	September 16–30	October 1–15	October 16–31	November 1–15	November 16–30	April 1–15	April 16–30	May 1–15	May 16–31	*n*
6A	1993/94	1	1	0	0	0	0	0	0	2	1	5
	1994/95	4	0	1	0	0	0	0	2	1	0	8
	1995/96	4	2	1	0	0	0	0	2	3	1	13
	1996/97	2	2	1	1	0	0	0	3	2	0	11
	1997/98	4	4	4	1	0	0	0	0	1	1	15
6B	1993/94	0	0	0	0	0	0	0	1	0	0	1
	1994/95	0	0	0	0	0	0	0	3	3	0	6
	1995/96	2	1	0	0	0	0	0	0	2	1	5
	1996/97	1	1	1	0	0	0	0	0	0	0	3
	1997/98	1	0	2	0	0	0	0	0	1	2	6
6C	1993/94	0	0	0	0	0	0	0	0	0	0	0
	1994/95	0	2	3	0	0	0	0	0	0	1	6
	1995/96	1	0	2	0	0	0	0	0	0	2	5
	1996/97	1	0	0	0	0	0	0	1	0	2	4
	1997/98	2	0	2	0	0	0	0	0	0	1	5
6D	1993/94	0	0	3	2	0	1	0	0	5	4	15
	1994/95	0	0	0	2	0	0	1	0	3	0	6
	1995/96	0	0	0	1	1	0	0	1	7	1	11
	1996/97	0	0	1	4	2	1	0	0	1	0	9
	1997/98	0	0	1	3	0	0	0	0	8	11	23
Unit 6 Total	1993/94	1	1	3	2	0	1	0	1	7	5	21
	1994/95	4	2	4	2	0	0	1	5	7	1	26
	1995/96	7	3	3	1	1	0	0	3	12	5	32
	1996/97	4	3	3	5	2	1	0	4	3	2	27
	1997/98	7	4	9	4	0	0	0	0	10	15	49

Table 6 Unit 6 brown bear harvest percent by transport method, 1993–97

Unit	Regulatory year	Percent of harvest							*n*
		Airplane	Boat	Airboat	3- or 4-wheeler	ORV	Highway vehicle	Unknown	
6A	1993/94	100	0		0	0	0	0	5
	1994/95	100	0		0	0	0	0	8
	1995/96	92	8		0	0	0	0	13
	1996/97	100	0	0	0	0	0	0	11
	1997/98	73	0	6	6	0	13	0	15
6B	1993/94	100	0		0	0	0	0	1
	1994/95	100	0		0	0	0	0	6
	1995/96	67	17		0	0	17	0	6
	1996/97	33	33	0	0	0	33	0	3
	1997/98	67	0	0	17	0	17	0	6
6C	1993/94	0	0		0	0	0	0	0
	1994/95	17	33		0	0	50	0	6
	1995/96	0	40		0	0	60	0	5
	1996/97	0	75	0	0	0	25	0	4
	1997/98	0	20	20	20	0	20	0	5
6D	1993/94	33	60		0	0	7	0	15
	1994/95	50	50		0	0	0	0	6
	1995/96	27	73		0	0	0	0	11
	1996/97	44	44	0	11	0	0	0	9
	1997/98	17	78	0	0	0	0	3	23
Total	1993/94	52	43		0	0	17	6	48
	1994/95	69	19		0	0	5	0	39
	1995/96	54	34		0	0	5	0	21
	1996/97	59	30	0	4	0	7	0	27
	1997/98	39	39	4	6	0	8	3	49

LOCATION

GAME MANAGEMENT UNITS: 7 (3520 mi^2) and 15 (4876 mi^2)

GEOGRAPHIC DESCRIPTION: Kenai Peninsula

BACKGROUND

Brown bears are throughout the remote lowland forests and intermountain valleys of the Kenai Peninsula, excluding coastal portions of Unit 7 and the eastern side of Kachemak Bay. Historical brown bear range remains occupied except in developed areas. Field observations and data analyses indicate brown bear densities are highest in the forested lowlands and subalpine areas west of the Kenai Mountains.

The Kenai Peninsula comprises primarily federal lands (71%). The U.S. Forest Service (FS) (Chugach National Forest, ca. 2000 mi^2) together with the National Park Service (NPS) (Kenai Fjords National Park, ca. 885 mi^2) are the principle landowners in Unit 7. In Unit 15 the U.S. Fish and Wildlife Service (FWS) (Kenai National Wildlife Refuge) is the primary landowner responsible for management of 3062 mi^2. Ownership of the remaining 29% of the Kenai varies between municipal, state, Native corporation, and other private lands.

Brown bears were first given game status in 1902 (Miller 1990*a*) with liberal seasons and bag limits. For example, in 1937–38 the season was 1 September to 20 June, and the bag limit was 2 brown bears for coastal areas in Southcentral and all of southeastern Alaska. The rest of the state did not have a closed season and there was no bag limit. At the time of statehood, the bag limit was 1 brown bear on the Kenai. The bag limit was further reduced in 1967 from 1 bear per year to 1 bear every 4 years. Cubs and sows with cubs were protected. The season dates have ranged from 20 to 45 days. In 1978 a 10-day spring season was opened for Unit 15 and extended to the current 15-day season (10–15 May) in 1980. The Unit 7 spring season opened in 1980 concurrently with Unit 15.

In 1984 representatives of the FWS, FS, and Alaska Department of Fish and Game (ADF&G) formed an Interagency Brown Bear Study Team (IBBST) to discuss brown bear management and research needs on the Kenai Peninsula and to coordinate joint studies. The NPS joined this effort in 1990. This group has coordinated many projects that have increased our understanding of brown bear ecology. The IBBST coordinated a baseline inventory (Bevins *et al.* 1984, Risdahl *et al.* 1986) of salmon streams and known high-use brown bear areas and detailed ground and habitat surveys (Schloeder *et al.* 1987 and Jacobs *et al.* 1988). Recently, this team expressed concern about the increasing trend in brown bear mortality on the Kenai and potential for additional bear mortality from human encroachment into bear habitat.

A cumulative effects model was developed to identify brown bear habitat on the Kenai at risk to human activities (Suring *et al.* 1998). In 1995 ADF&G initiated a research project in cooperation with the other members of the IBBST to evaluate the cumulative effects model, assess brown bear habitat, estimate survival of bears, and ultimately model the brown bear population on the Kenai (Schwartz and Arthur 1996, Schwartz *et al.* 1999). This project is scheduled to run through FY00.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Maintain a population of 250 brown bears with a sex and age structure that will sustain a harvest of less than 40 % females (3-year average of 6 female units).

METHODS

Cost-effective survey techniques to determine brown bear population size over large forested areas have not been developed and tested. We derived a population estimate for the Kenai by combining results from a habitat-based model and a density estimate using expert interpretation. Suitable brown bear habitat was estimated by mapping (1:250,000 topographic map) harvest locations of brown bears killed between 1961 and 1993. We approximated the area used by brown bears by including similar habitat surrounding the harvest location and calculated the area within the polygon for each game management unit. We included all land above mean high tide, roads, water bodies (except Skilak and Tustumena lakes), and municipalities. We assumed that all bears were harvested within their normal home ranges and that similar adjacent land was also suitable habitat.

By comparing estimates of bear density to other parts of Alaska, we could approximate the density on the Kenai by assessing expert impressions. At least 16 density estimates have been completed in Alaska from low densities in the northern Interior to very high densities in coastal areas (Miller 1997, Miller *et al.* 1997). Miller (pers commun) suggested that the density of brown bears on the Kenai was probably lower than 27.1 bears per 1000 km^2 (7.0 bears per 100 mi^2) that he reported for his middle Susitna Study Area (1987). Consequently, we estimated the bear density on the Kenai to be 20 bears per 1000 km^2 (5.2 bears per 100 mi^2), and we calculated the suitable habitat to be 13,848 km^2 (5347 mi^2). We derived a brown bear population estimate for Units 7 and 15 by multiplying the suitable habitat by the density estimate.

In the spring of 1995, the department drafted a Brown Bear Management Protocol. This protocol described the desired management strategies to achieve management objectives. This protocol is evaluated and updated annually (Appendix A).

Since 1961, a mandatory sealing program has provided information on all harvested bears, including distribution and sex-age composition. Harvest data is reported using the division's reporting program BEARSEAL.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Assuming that the brown bear density was 20 bears per 1000 km^2 (5.2 bears per 100 mi^2) and the suitable habitat was 13,848 km^2 (5347 mi^2), we estimated the brown bear population for Units 7 and 15 at 277 (range = 250–300). We believe the population is stable or may be slightly increasing.

Distribution and Movements

Brown bears are throughout the Kenai Peninsula with the exception of coastal areas of Kenai Fjords National Park and the southern portions of the peninsula (Schloeder *et al.* 1987, Jacobs *et al.* 1988). Recently park personnel have observed brown bears in KFNP (Nuka Bay) and occasionally on the southern side of Kachemak Bay. It is unknown at this time whether this is a result of dispersing bears or range extension of the population.

MORTALITY

Harvest

Season and Bag Limit. The bag limit for Units 7 and 15 was 1 bear every 4 regulatory years. The bear hunting season for this reporting period was 1 October–25 October and 10–25 May for subsistence, resident, and nonresident hunters.

Board of Game Action and Emergency Orders. In 1989 the Board of Game shortened the fall brown bear season by 14 days, creating a fall opening date of 15 September. This change was to reduce the incidental take of brown bears by moose hunters. During the spring 1994 Board of Game meeting, the board shortened and moved the fall hunting season to 1–25 October in response to continued high harvests. The board again addressed the bear season in 1997 and authorized the department to operate the hunts as registration permit hunts. The fall seasons from 1995–1998 were closed by emergency order because additional harvest from the fall season would have exceeded management objectives. Because of these closures, we determined that only 1 season would be allowable on the Kenai to stay within management objectives. The Board of Game authorized a fall-only registration hunt beginning in the fall of 1999. The season dates were also changed to 15–31 October. To stay within objectives, the spring hunt in 1999 was closed by emergency order.

The department drafted a proposal to the Board of Fisheries to close Russian Creek (also known as Goat Creek) to fishing for the month of August to protect brown bears feeding in this area. The Department of Law advised the Board of Fisheries that they did not have the authority to regulate a fishery for wildlife conservation purposes. The proposal was redrafted to protect spawning salmon 300 yards upstream from the inlet of upper Russian Lake and passed by the Board of Fisheries in 1999. This closure will take effect in August of 1999.

Hunter Harvest. Eleven bears were taken during regulatory year 1996–97. The fall 1996 season was closed by emergency order. Hunters harvested 6 bears (1 male (17%), 5 females (83%) during the spring season (Table 1). Five male bears were taken as nonsport (all defense of life or property) mortalities. Three of these bears were taken during the fall of 1996 and 2 were killed in spring of 1997.

Seventeen bears were taken during regulatory year 1997–98. The fall 1997 season was also closed by emergency order. Eleven bears, 5 males (45%) and 6 females (55%), were reported taken in the spring 1998 registration hunt (Table 1). Seventy-four permits were issued and 47 reported hunting. This is considered a minimum number of hunters because hunters that did not obtain permits harvested 4 of the 11 bears. Additionally, 3 of the 11 bears were not legal bears. A sow and yearling female were killed together and a yearling male was also taken.

Hunter Residency and Success. Local residents took 33% and 63% of the bears harvested in regulatory years 1996–97 and 1997–98, respectively. Nonlocal residents took 67% and 37%, respectively (Table 2). Only 1 nonresident hunter obtained a permit but was unsuccessful.

Harvest Chronology. All hunter-harvested bears were taken during the spring season (May 10–25) (Table 3). It is interesting to note that all bears taken in Unit 7 during this reporting period (n = 5) were taken during the last half of the season, yet bears taken in Unit 15 were equally divided between the first half (n = 5) and last half (n = 4).

Transport Methods. Successful brown bear hunters have used all transportation methods with the exception of snow machines during the past 5 years. In 1996 most hunters used airplanes and boats (33% each); less common transportation modes were walking and highway vehicles. In 1997 most hunters used highway vehicles (38%); hunters also used 4-wheelers and walking (25% each), and 12% of successful hunters used boats (Table 4). Based on sealing certificates, all hunters that reported walking as their transportation method also used highway vehicles.

Nonregulatory Management Problems/Needs

The department in conjunction with the IBBST has initiated a management-planning project. This project was initiated in 1997, postponed until 1998 due to personnel changes, and is scheduled for completion in FY00. The IBBST is currently drafting a conservation assessment that will provide the framework for this stakeholder-driven planning process.

As interim chair of the IBBST, I drafted a request to the Commissioner of ADF&G to list the Kenai population of brown bear as a population of special concern. This request was based on the potential for decline in the future because of human encroachment into brown bear habitat. The Kenai brown bear was officially listed on 27 November 1998 as a Species of Special Concern.

Timber harvests designed to salvage damaged timber and control the spread of spruce bark beetles (Dick *et al.* 1992) could be a major factor affecting the abundance of brown bears. The Forest Health Management Plan encompasses approximately 60% of the Kenai Peninsula and most of the brown bear habitat. The plan prioritizes over 426,000 acres of forested lands for salvage cutting. Logging mature forests may affect brown bears in numerous ways, including fragmentation of forest habitat and increased public access through an extensive road system. ADF&G and the IBBST have routinely commented on proposed timber sales that could significantly impact brown bears.

CONCLUSION AND RECOMMENDATIONS

The 10-year average harvest of female bears was 6 female units (range = 4.5–8.5 units per year). Management objectives have been met but are at upper limits. The number of DLP's and illegally taken bears increased throughout the 1990s, essentially replacing hunter harvest as the primary source of mortality. We are concerned that this trend will continue and long-term management objectives will eventually be exceeded and all hunting opportunity lost.

Miller (1990*b*) used computer simulations to derive a maximum sustainable hunting mortality rate of 5.7% of a population of brown bears under optimum productivity in Unit 13. We have

applied this maximum mortality rate to the Kenai population, recognizing its limitations. We recommend that the department run Miller's model with Kenai Peninsula data collected recently to calculate a maximum sustainable mortality for this area.

Taylor *et al.* (1987) noted that survival of adult female bears was the predominant factor affecting population dynamics. To maintain a population of 250 bears on the Kenai Peninsula, our objectives have been set at a 3-year mean annual harvest of 6 females (approximately 40% of the annual harvest objective of 14 bears). A 3-year mean allows for abnormal harvest variations caused by weather, food availability, or temporary changes in human-use patterns. We refined the desired harvest rate quota by using the point system similar to Smith's (1989) to account for young female bears ($\leq$ 2 years of age) taken primarily in nonsport situations. These bears were assumed to have a lower reproductive value and therefore should be assigned lower scores than those of older females. Specifically, female bears $\leq$ 2 years of age were assigned only half the value of older females.

We need to closely monitor the harvest of adult female bears from all sources. If the mean harvest is substantially above the recommended annual quota of 6 female units, the department should adjust the hunting season through emergency action. The hunting season is the only mortality source that can be controlled short term. A management protocol was originally drafted in 1995 to specify management actions to be taken (Del Frate 1996). It is updated annually (Appendix A).

The long-term health of brown bears on the Kenai Peninsula depends upon maintaining quality bear habitat and minimizing the mortality of female bears. There are 2 activities that may negatively affect bear abundance. Forestry practices to salvage timber killed by spruce bark beetles may affect bears through the logging of mature forest stands and the building of roads into previously inaccessible areas (McLellan and Shackleton 1988). Perhaps more importantly, commercial, recreational, and residential developments on the Kenai Peninsula will continue to reduce the quantity and quality of brown bear habitat and restrict travel corridors for bears. Human encroachment into bear habitat will increase bear/human encounters and increase the probability that bears will be killed.

We need to continue to monitor sport and nonsport bear mortality by season, location, and cause to identify tangential management issues that may affect long-term survival. Potential issues have been identified, such as bear/human conflicts, bear/livestock interactions, competition between bears and sport fishermen, big game seasons that overlap with brown bear seasons, brown bears taken near black bear bait stations, and private and borough dumpster problems. Solving many of these management concerns will take new and innovative approaches. The proposed stakeholder approach will provide the type of public collaboration necessary to address many of these issues.

The Kenai Peninsula brown bear population is essentially closed. Appreciable immigration is unlikely because the city of Anchorage is adjacent to the Kenai and brown bears are not at high densities in the area around Turnagain Arm. Because the Kenai Peninsula is essentially a closed system, some areas that could support slightly higher harvests can serve as refugia for the more highly impacted areas.

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Table 1 Units 7 and 15 brown bear harvest, 1991–97

Regulatory year	Reported: Hunter Kill M	F	Unk.	Total	Reported: Nonhunting kill[a] M	F	Unk.	Total estimated kill: M	(%)	F	(%)	UNK.	(%)	Total
1991														
Fall 91	4	4	0	8	1	1	0	5	(50)	5	(50)	0	(0)	10
Spring 92	3	1	0	4	0	0	1	3	(60)	1	(20)	1	(20)	5
Total	7	5	0	12	1	1	1	8	(53)	6	(40)	1	(7)	15
1992														
Fall 92	4	6	0	10	3	0	1	7	(50)	6	(43)	1	(7)	14
Spring 93	9	4	0	13	0	0	0	9	(69)	4	(31)	0	(0)	13
Total	13	10	0	23	3	0	1	16	(59)	10	(37)	1	(4)	27
1993														
Fall 93	5	3	0	8	3	1	0	8	(67)	4	(33)	0	(0)	12
Spring 94	6	2	0	8	3	0	0	9	(82)	2	(18)	0	(0)	11
Total	11	5	0	16	6	1	0	17	(74)	6	(26)	0	(0)	23
1994														
Fall 94	3	3	0	6	4	3	0	7	(54)	6	(46)	0	(0)	13
Spring 95	2	4	0	6	1	0	0	3	(43)	4	(57)	0	(0)	7
Total	5	7	0	12	5	3	0	10	(50)	10	(50)	0	(0)	20
1995														
Fall 95	0	0	0	0	1	5	0	1	(17)	5	(83)	0	(0)	6
Spring 96	3	2	0	5	2	2	0	5	(56)	4	(44)	0	(0)	9
Total	3	2	0	5	3	7	0	6	(40)	9	(60)	0	(0)	15
1996														
Fall 96	0	0	0	0	3	0	0	3	(100)	0	(0)	0	(0)	3
Spring 97	1	5	0	6	2	0	0	3	(38)	5	(62)	0	(0)	8
Total	1	5	0	6	5	0	0	6	(55)	5	(45)	0	(0)	11
1997														
Fall 97	0	0	0	0	3	3	0	3	(50)	3	(50)	0	(0)	6
Spring 98	4	4	0	8	1	2	0	5	(45)	6	(55)	0	(0)	11
Total	4	4	0	8	4	5	0	8	(47)	9	(53)	0	(0)	17

[a]Includes DLP kills, research mortalities, and other known human-caused mortality.

Table 2 Unit 7 and 15 brown bear successful hunter residency, 1985–97

Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total successful hunters[b] *n*
1985–86	6	(40)	7	(47)	2	(13)	15
1986–87	11	(69)	4	(25)	1	(6)	16
1987–88	4	(33)	5	(42)	3	(25)	12
1988–89	7	(58)	0	(00)	5	(42)	12
1989–90	4	(67)	1	(17)	1	(17)	6
1990–91	7	(64)	1	(9)	3	(27)	11
1991–92	5	(42)	3	(25)	4	(33)	12
1992–93	11	(48)	8	(35)	4	(17)	23
1993–94	10	(63)	2	(13)	4	(25)	16
1994–95	3	(25)	8	(67)	1	(8)	12
1995–96	4	(80)	1	(20)	0	(0)	5
1996–97	2	(33)	4	(67)	0	(0)	6
1997–98	5	(63)	3	(37)	0	(0)	8

[a] Local resident means residents of Units 7 or 15.

[b] Does not include nonsport harvest.

Table 3 Units 7 and 15 brown bear harvest chronology percent by month, 1985–97

Regulatory year	Harvest periods September	October	May	n[a]
1985–86	60	20	20	15
1986–87	56	19	25	16
1987–88	42	25	33	12
1988–89	75	0	25	12
1989–90	33	0	67	6
1990–91	55	0	45	11
1991–92	58	8	33	12
1992–93	39	4	57	23
1993–94	13	38	50	16
1994–95	0	50	50	12
1995–96	0	0	100	5
1995–96	0	0	100	6
1996–97	0	0	100	8

[a] Does not include nonsport harvest.

Table 4 Units 7 and 15 brown bear harvest percent by transport method, 1985–97

Regulatory year	Percent of Harvest									
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Walk	Unk.	n^a
1985	7	13	33	0	0	13	7	7	20	15
1986	12	6	19	0	0	19	12	12	19	16
1987	25	33	17	0	0	0	33	0	0	12
1988	8	42	8	0	0	17	17	0	8	12
1989	17	0	33	0	0	0	0	17	33	6
1990	9	27	9	9	0	9	18	9	9	11
1991	17	25	17	0	0	8	8	8	17	12
1992	13	13	17	13	0	4	30	9	0	23
1993	0	6	69	6	0	0	19	0	0	16
1994	0	17	17	0	0	0	58	0	8	12
1995	0	0	0	40	0	0	60	0	0	5
1996	33	0	33	0	0	0	17	17	0	6
1997	0	0	12	25	0	0	38	25	0	8

[a] Does not include nonsport harvest.

Appendix A.

BROWN BEAR MANAGEMENT PROTOCOL

Last update October 20, 1998

BACKGROUND

Brown bear management on the Kenai Peninsula continues to be challenging. Human-related mortality has increased substantially in recent years, despite regulatory actions to reduce sport hunting. In 1989, the Board of Game shortened the fall brown bear season by 14 days creating a fall opening date of 15 Sept. in an effort to reduce the incidental mortality caused by moose hunters. In 1994 the Board shortened and moved the fall season to 1–25 October in response to continued high harvest levels. This regulatory change succeeded in reducing the fall harvest. However, a high defense of life and property mortality during 1994 negated the effects of the shorter season. This protocol will recommend both short term and long-term management strategies.

In 1984 representatives of the U.S. Fish and Wildlife Service, U.S. Forest Service and the Alaska Department of Fish and Game formed the Interagency Brown Bear Study Team (IBBST) to discuss brown bear management and research needs on the Kenai Peninsula and to coordinate joint studies. In 1990 the National Park Service formally joined this group. Most recently, this team has expressed concern about the increasing trend in brown bear mortality on the Kenai and the potential for additional mortality from human encroachment into bear habitat.

The total area of suitable habitat for brown bears is approximately 13,848 km^2 (5409.4 mi2) and is equivalent to 63% of the Kenai Peninsula landmass (Del Frate 1993). Miller (pers. comm.) suggested that the density of brown bears on the Kenai is probably lower than he reported for the middle Su hydro study area (27.1 bears per 1000 km^2) Miller 1987). Therefore, we assumed the density of bears on the Kenai was approximately 20 bears per 1000 km^2. A point estimate of 277 bears was then calculated for 13,848 km2 of suitable habitat. For the purposes of this management exercise a conservative population estimate of 250 was used to allow for unoccupied bear habitat in and around municipalities.

In the 1990–92 Brown Bear Management Report we recommended a sustainable harvest rate of 14 bears with fewer than 6 females (Del Frate 1993). Smith (1989) used a sex-weighted point system to encourage guides and outfitters to take predominantly males in Yukon Territories. By assigning females with a greater point value and then allocating guides with a certain number of points, it was in the guides' best interest to harvest males. Management on the Kenai differs from the Yukon in that the guide proportion of the bear mortality is very small (1 of 23 harvested in 1994 and 6 of 25 in 1993). However, the point system has some applicability for season closures when the total number of female points has been reached.

We refined the desired harvest rate quota by using the point system to account for young female bears (<3 years of age) that were taken primarily in nonsport situations (Del Frate 1995). These bears were assumed to have a lower "reproductive value" and therefore should not count as much as older bears. Specifically, female bears <2 years of age were assigned only half the value of

older female bears. The new sustainable harvest rate should not exceed 5.6 "female units." This system compensates for years when higher than normal yearling and 2-year-old harvest occur.

MANAGEMENT OBJECTIVES

The management objectives for the Kenai Peninsula are to maintain an estimated population of 250 brown bears with a sex and age structure that will sustain a harvest comprised of at least 60% males.

MANAGEMENT STRATEGIES

We should consider the following protocol for long-term management of Brown bears on the Kenai Peninsula.

- Maintain seasons and bag limits that are most attractive to brown bear hunters and least impacted by other incidental mortality.
- Manage bears on the Kenai Peninsula as a closed population. There is probably very little immigration since the Municipality of Anchorage is adjacent to the Kenai and the area around Turnagain Arm is not known for high brown bear densities. Decisions should not be made for one subunit that may negatively impact brown bears in other areas. Furthermore, since the Kenai is "closed" areas that may be slightly under harvested can serve as refugia for areas with higher impact.
- Base all management decisions on a 3-year average of all mortality data. Three years allow for any abnormal harvest variations because of weather, food availability, or human use patterns.
- Maintain a harvest objective of no more than 5.6 female units based on a 3-year average. Consider females <3 years old as half the value of older females (0.5 female units). At the current levels of harvest the number of females taken in any given year will determine the growth or decline of that population. Because bears are polygamous breeders the number of males may not be as crucial. In future years if the harvest of males continues to increase we may need to set a numerical limit.
- Management decisions should then be made for the next calendar year by calculating the total number of female units taken the previous 2 years. If the previous years harvests were excessive and it is necessary to make a decision for the following year, it can be made well in advance of the spring season. The Department could also make any necessary changes to the upcoming regulation book before printing.
- Spring seasons appear to be the most desirable to direct the sport harvest. The proportion of males to females taken is highest and the proportion of incidentally taken bears is the lowest. Therefore, any restrictions should first be considered for the fall season. During the fall season there are many other activities occurring where bears may be taken incidentally.
- Base all management decisions on calendar years. Spring harvests should continue to be monitored to determine if any inseason changes are necessary for the fall. Management decisions can still be made by July 1 after all spring bears have been handled and sealed.

- If necessary, require sealing in a timely manner (5–10 days) if harvest assessment cannot be accomplished with a 30-day requirement. I would not recommend this at this time unless we have to manage bears in season. A request to all sealers to estimate age of the bears would also help to properly assign points to female bears.

- Include all known human caused removals (i.e., harvest, trap and transplant, roadkill, DLP etc.) when determining future allowable harvest.

- Monitor the sport and nonsport harvest by season, location, and cause to identify any non brown bear management issues that may affect the mortality of bears. Potential issues include other big game seasons that overlap with brown bear seasons, brown bears taken in proximity to black bear bait stations, bear/human conflicts in important bear habitat (i.e., Russian River Skilak lake campgrounds, and Caribou Hills cabin areas), private and Borough dumpster problems, and bear/livestock interactions. Make recommendations to the respective agencies, departments, or divisions to alleviate future problems and reduce nonsport harvest of bears.

Review this protocol following any significant changes in population parameters or sustainable harvest calculations.

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RECOMMENDED ACTION FOR 1995

Given the above protocol and the trend in figure 2, I recommend the following:

- The harvest objective is 5.6 female units per year or 16.8 for 3 years. Six female units were taken in both 1993 and 1994. The total allowable harvest for 1995 would then be a maximum of 4.8 female units.

- Allow the spring season to run its course. In the past 15 years the spring harvest averaged only 5.2 bears and 1.4 females >2. In the past 5 years the average was 7.8 bears and 2.0

females >2. Using the above point system for females the 15-year average was 1.6 females and the 5-year average was 2.3. If the 1995 spring harvest is equal to the previous 5 year mean and that is the only harvest, then we would be within 2.5 females of the 3-year quota. Three female bear units were taken in defense of life and property during the fall portions of 1992 and 1993. We should allow for some DLP mortality for the rest of 1995.

- Close the fall brown bear season by emergency order and list the closed season in the 1995–96 regulation book. Assuming an average spring harvest of 2.3 bears (by points), we would be within 0.8 female bears of our 3-year mean without considering DLP's or other nonsport kills. Therefore, I would recommend that the EO be written after the spring season so we don't encourage additional hunters in the spring.

- Reevaluate the 1995 brown bear mortality in November. At this point we should consider whether to draft a proposal for the Board of Game or use emergency order authority for a couple of years. The big unknown is how many nonsport kills we will have this year.

RECOMMENDED ACTION FOR 1996

Given the above protocol and the trend in figure 2, I recommend the following:

- The harvest objective is 5.6 female units per year or 16.8 for 3 years. Six female units were taken in 1994 and 8 units in 1995. The total allowable harvest for 1996 would then be a maximum of 2.8 female units.

- Allow the spring season to run its course. In the past 15 years the spring harvest averaged only 5.2 bears and 1.4 females >2. In the past 5 years the average was 7.8 bears and 2.0 females >2. Using the above point system for females the 15-0year average was 1.6 females and the 5-year average was 2.3which would allow for a spring season.

- Close the fall brown bear season by emergency order and list the closed season in the 1996–97 regulation book. An average spring harvest of 2.3 bears (by points) would fill the annual quota without considering DLP's or other nonsport kills. Therefore, I would recommend that the EO be written after the spring season so we don't encourage additional hunters in the spring.

- Reevaluate the total 1996 brown bear mortality in November. At this point we should consider whether to draft a proposal for the BOG or use EO authority for a couple of years. The big unknown is how many non sport kills we will have this year.

RECOMMENDED ACTION FOR 1997

Given the above protocol I recommend the following action to be taken in 1997:

- The harvest objective is 5.6 female units per year or 16.8 for 3 years. Eight female units were taken in 1995 and 3 units in 1996. The total allowable harvest for 1997 would be a maximum of 5.8 female units.
- Implement registration permit hunts for both spring and fall seasons. Registration hunts will allow the department to assess hunter effort specifically on the Kenai. Other methods (ie tag sales and bear sealing data do not give an indication of unsuccessful hunters.

- Allow the spring season to run its course. In the past 15 years the spring harvest averaged only 5.2 bears and 1.4 females >2. In the past 5 years the average was 7.8 bears and 2.0 females >2. Using the above point system for females the 15-year average was 1.6 females and the 5 year average was 2.3which would allow for a spring season.

- Reduce the fall brown bear season through Board of Game action. The recommended season should be the last 2 weeks of October.

- Close Game management subunit 15A to brown bear hunting during the fall. Intensive searches by research staff during the past 2 years indicate that only a limited number of bears occur in subunit 15A. During the Fall season these bears are susceptible to harvest because many are concentrated on salmon streams (notably the Kenai River and Chikaloon Rivers)

- Monitor the spring harvest and DLP kills for signs of excessive take of females. If take is excessive (i.e., the total quota of females gets taken) take emergency action to close or further reduce the fall season.

- Reevaluate the total 1997 brown bear mortality in November. Consider management options for 1998.

RECOMMENDED ACTION FOR 1998

Given the above protocol I recommend the following action to be taken in 1998:

- The harvest objective is 5.6 female units per year or 16.8 for 3 years. Three units were taken in 1996 and 7.5 units in 1997. The maximum allowable harvest for 1998 would then be no more than 6.3 female units.

- We implemented registration permit hunts for this spring seasons and 74 permits were issued. Eleven bears were harvested however only 7 bears were harvested by permittees suggesting that there were over 100 hunters in the field. Three permittees never turned in their permit reports and their names were turned over to FWP for citations. We need to continue the registration permit system and improve on our public notification.

- Monitor the spring harvest and DLP kills for signs of excessive take of females. Eleven bears were taken during the spring season including 6 females. The spring harvest was 5 units (one female was a yearling and the other was a 2-year-old). Additionally, as of October 20, 4 bears have been reported taken as DLP's. One of those bears was an adult female. That brings the total take to 6 units for 1998. Any additional mortality of female bears will exceed management objectives. Emergency order was issued closing the fall season on August 17.

- Prior to 1996, the past 15 spring harvests averaged only 5.2 bears and 1.4 females >2. In the past 5 years the average was 7.8 bears and 2.0 females >2. Using the above point system for females, we estimated the 15-year average was 1.6 females and the 5-year average was 2.3, which would allow for a spring season. In 1997, 5 of 6 bears taken during the spring season were female bears. In 1998, 6 of 11 bears were females. This trend indicates that female bears

are becoming more vulnerable during the spring and we may need to take action that affects that season.

We need to evaluate the brown bear seasons and bag limits on the Kenai and consider proposing changes to the Board of Game. Possible changes include eliminating either spring or fall season, shorten or move one or both season dates, and change or remove black bear baiting regulations on the Kenai peninsula. Another possibility would be to go to a system similar to the Alaska Peninsula with seasons every other year.

PREPARED BY:

Gino Del Frate
Wildlife Biologist

REVIEWED BY:

Ted Spraker
Wildlife Biologist

LOCATION

GAME MANAGEMENT UNIT: 8 (5097 mi^2)

GEOGRAPHIC DESCRIPTION: Kodiak and Adjacent Islands

BACKGROUND

Brown bears inhabit Kodiak, Afognak, and adjacent smaller islands in stable and relatively high populations. Most habitats are remote and relatively undeveloped, except in northeastern Kodiak Island near the city of Kodiak. The Kodiak National Wildlife Refuge (NWR), created by executive order of President Franklin D. Roosevelt in 1941, originally contained approximately 60% of the 3 million acres of bear habitat in Unit 8. Several hundred thousand acres of land, including approximately 310,000 acres of the Kodiak NWR, were conveyed to Native village corporations under the Alaska Native Land Claims Settlement Act of 1971 (ANCSA) and through the Alaska National Interest Lands Conservation Act of 1980 (ANILCA). Approximately 50% of the Refuge land was repurchased with funds provided by the Exxon Valdez Oil Spill Trust and various conservation organizations in 1996. Ongoing development of privately owned lands for seasonal residences, lodges, and recreational cabins threatens the integrity of important brown bear habitat. Logging, hydroelectric power development, commercial fishing, and increasing recreational use of brown bear habitat by hunters, sport fishers, and tourists are other sources of conflict with brown bears.

Brown bear management in Unit 8 has evolved from virtually unregulated commercial harvests before 1925 to the present system of closely regulated permit hunting. Troyer (1961) documented the early history of brown bear hunting and federal management until 1960, when the Alaska Department of Fish and Game (ADF&G) assumed management. At that time, recreational hunting for brown bears was well established with an 8-month general season.

Brown bears and cattlemen have endured a rocky relationship on Kodiak Island. In 1794 the Russians introduced cattle, but it wasn't until the early 1900s that large herds were established (Eide 1964). Throughout this time bears were routinely killed whenever they came in proximity to cattle. Cattlemen lobbied for government actions to reduce or eliminate bears from their range (Sarber 1939), and several efforts were attempted. However, each effort was curtailed because of the time and expense required. Following an ADF&G study in the early 1960s (Eide 1964), the department established a policy that future bear/cattle conflicts would be resolved through the State's defense of life or property provisions (5 AAC 92.410) and liberal sport hunting seasons near the ranches on northeast Kodiak.

In the mid-1960s, high harvests prompted ADF&G to close the fall season in the Karluk Lake and Uyak Bay areas in 1967 and 1968. The U.S. Fish and Wildlife Service (FWS) subsequently imposed a land-use permit requirement for brown bear hunting on the Kodiak NWR in 1968 to distribute hunting effort and harvests. Although that system initially reduced harvests and promoted better hunter distribution, increases in hunting effort and harvest beginning in 1972 prompted the FWS to limit the number of land-use permits in 1975. The department objected that limiting hunters encroached on state authority to manage resident wildlife. The Board of Game responded by establishing a limited permit hunting system, beginning with the spring 1976

season. The FWS subsequently dropped the land-use permit system. The state system allocated a minimum of 60% of the available bear permits to Alaska residents. A fixed number of permits was assigned to each of 26 hunting areas with approximately a 60:40 ratio of resident to nonresident allocations within each hunting area.

The Guide Licensing and Control Board assigned exclusive guiding areas to 20 guides in Unit 8 in 1975. Each guide was guaranteed access to nonresident hunting permits for clients under the system. However, the Alaska Supreme Court declared exclusive areas unconstitutional in 1988, which created an opportunity for additional licensed guides to begin operating in Unit 8. Subsequently, frequent disputes among guides competing for permits prompted the department to recommend nonresident permits be awarded by lottery as was done from 1976 through 1982. The board adopted the recommended change in the 1994–95 season, with provisions for issuing permits over-the-counter for undersubscribed hunts and for filling cancellations from an alternate list. The FWS cited conservation concerns in limiting big game guiding privileges on the Kodiak NWR to 13 guides in 1993.

State hunting regulations allowed for a subsistence bear hunt in 1986/87, with hunters required to salvage all bear meat for human consumption. This regulation was rescinded the next year; however, in spring 1997 a federal hunting regulation reinstated a subsistence season. Under the Federal regulation up to 10 permits were available to residents of remote Kodiak Island villages. Permits were valid only on Federal lands, and the seasons were 1–15 December and 1 April–15 May. All meat from bears harvested under this regulation was required to be salvaged for human consumption.

Except for the changes in issuing permits to nonresidents, only minor changes in bear hunting regulations have occurred since 1976. Afognak and part of northeastern Kodiak Island were changed from an unlimited permit hunt to a limited permit hunt in 1987–88.

Research by FWS and ADF&G on several aspects of population status and life history of the Kodiak brown bear has been underway since 1982 (Barnes 1986; 1990; Barnes and Smith 1995; Smith and Van Daele 1988; 1990; Van Daele *et al.* 1990). A density estimation technique developed by Miller *et al.* (1987) was applied to 2 study areas on Kodiak Island in 1987, and the brown bear population in Unit 8 was estimated (Barnes et al. 1988). Barnes (1993) monitored movements of brown bears in relation to deer hunting activity on western Kodiak Island, recommending additional effort to document unreported killing of bears and improved educational programs for deer hunters.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

1. Maintain a stable brown bear population that will sustain an annual harvest of 150 bears composed of at least 60% males.

2. Maintain diversity in the sex and age composition of the brown bear population, with adult bears of all ages represented in the population and in the harvest.

3. Limit human-caused mortality of female brown bears to a level consistent with maintaining maximum productivity.

METHODS

We collected harvest data from mandatory hunter reports and the sealing program. During sealing hunters were required to bring the hide and skull of each bear harvested in Unit 8 to the Kodiak ADF&G office for inspection. We determined bear ages from cementum annuli of premolar teeth removed from each bear. Mandatory hunting reports provided information on hunting effort and success. We monitored hunting activity in the field with periodic patrols by boat and aircraft.

Brown bear population estimates were developed for 9 study areas with the "intensive aerial survey technique" (IAS) detailed in Barnes and Smith (1997*a*) and previously reported in Smith (1995). Data from these surveys were extrapolated to develop a unitwide bear density and population estimate. We also cooperated with Kodiak NWR staff to conduct aerial brown bear composition surveys along selected streams of southern Kodiak Island.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Recent estimates of the Unit 8 brown bear population compare closely with estimates made in the 1950s, although a slightly increasing trend in hunting mortality and in nonsport mortality has occurred since the early 1970s. The bear population has increased in northeast Kodiak Island since the early 1970s because of more restrictive seasons and reduced killing of bears responsible for livestock depredation. Since 1976 permits have closely regulated hunting, and the brown bear population is stable.

Population Size

We have worked closely with staff from Kodiak NWR to conduct 10 intensive aerial brown bear surveys from 1987 to 1997 (Table 1). These surveys were in 9 separate areas on Kodiak Island, and 1 area (Terror Lake) was surveyed twice. Data from these surveys were extrapolated to estimate the total bear population on the archipelago (Barnes and Smith 1997, Barnes and Smith 1998). The estimated population size was 2980 bears, 2085 of which were independent (>3 years old). There were an estimated 330 bears on the islands north of Kodiak, 208 bears on northeast Kodiak, 665 on southeast Kodiak, 1088 on southwest Kodiak, and 689 on northwest Kodiak. The average density on Kodiak Island was 265 bears/km^2 (0.7 bears/mi^2), and for the northern islands it was 142 bears/1000 km^2 (0.4 bears/mi^2). We have not conducted aerial surveys on Afognak or the other northern islands where dense Sitka spruce (*Picea sitchensis*) forest makes it difficult to observe bears, so the population estimates for those areas are tentative.

Aerial surveys along salmon streams in southwestern Kodiak Island by the FWS indicated little change in composition of the brown bear population (Table 2). Single bears composed 40% and 37% of the bears classified in 1996 and 1997, respectively.

Distribution and Movements

There have been several investigations of brown bear movements and population dynamics on Kodiak Island. Most involved radiotelemetry and lasted at least 3 years. The Karluk Lake area was investigated from 1954 to 1962 (Troyer and Hensel 1967), the Terror Lake area from 1982 to 1987 (Smith and Van Daele 1990), southwest Kodiak from 1983 to 1987 (Barnes 1990), the Aliulik Peninsula from 1992 to 1996 (Barnes and Smith 1997*b*), and the Spiridon Peninsula from 1991 to 1997 (Barnes, in prep). The denning characteristics of bears in the Terror Lake and the southwest Kodiak areas were described and compared in 1990 (Van Daele *et. al.* 1990). We are currently working on a compendium of these and other research results to develop a more concise picture of bear ecology on the Kodiak archipelago.

MORTALITY

Harvest

Since statehood, the reported sport harvests of bears in Unit 8 have ranged from 77 (1968–69) to 206 (1965–66) per regulatory year (Table 3). In recent years regulations have been more consistent and designed to better distribute the hunting pressure. From 1980–81 to 1989–90 the average annual harvest was 165.4 bears (range = 124–195), and from 1990–91 to 1997–98 the average was 160.1 bears (range = 149–177). Assuming a stable bear population of 2890 bears (2085 independent bears), we estimate sport hunters are harvesting 5.5% of the bear population annually (7.8% of the independent bears).

Season and Bag Limit. The season for residents and nonresidents in that portion of Kodiak Island east of a line from the mouth of Saltery Creek to Crag Point, and including Spruce Island, was 25 October–30 November and 1 April–15 May. The bag limit was 1 bear every 4 regulatory years by registration permit only. In the remainder of Unit 8, the season dates were the same, and the bag limit was 1 bear every 4 regulatory years by permit only. Residents, and nonresidents accompanied by a resident within the second degree of kindred, could take bear by drawing permit only. Drawing and registration permits were available for nonresidents guided by a registered, master, or Class A assistant guide.

Board of Game Actions and Emergency Orders. The Board of Game addressed proposals to eliminate bear hunting in the Karluk Lake area during their spring 1997 meeting, but made no changes to the existing regulations. There were no proposals addressing Unit 8 bear seasons during the spring 1999 board meeting; however, there was a proposal to limit harvest to 1 bear/lifetime and another requiring licenses and permits for individuals accompanying bear hunters in the field. Neither proposal passed.

The Federal Subsistence Board authorized an additional hunt on federal lands for subsistence hunters. This regulation authorized issuance of up to 10 federal permits to residents of remote Kodiak Island villages to harvest 1 bear per year for human consumption. Season dates for the new hunt were 1–15 December and 1 April–15 May.

Hunter Harvest. Hunters harvested 162 bears in regulatory year 1996–97 and 167 bears in 1997–98, a rate slightly above the previous 5-year mean of 160.2 bears (Table 3). There were 48 bears killed in fall 1996 and 53 killed in fall 1997. The mean annual fall harvest for the previous 5

years was 53.0 bears. During both spring of 1997 and 1998, 114 bears were killed, a rate somewhat higher than the previous 5-year mean of 107.6 bears. These totals do not include bears killed under federal subsistence regulations: 2 bears (1 male, 1 unknown sex) in 1996–97 and 4 (3 males, 1 female) in 1997–98.

Males predominated in the harvest, composing 77.2% of the sport harvest in 1996–97 and 72.5% in 1997–98, a rate well above the previous 5-year average of 65.4%. Although the current management objective of 60% males was met both years, Miller (1990*a*) cautioned that using sex and age ratios to set allowable harvest objectives is more likely to result in overexploitation than using total adult females for setting guideline harvests. Sport hunters harvested 37 females in 1996–97 and 45 females in 1997–98, well below the annual mean of 54.2 females harvested during the preceding 5 years. Including other human-caused deaths of females, 44 females were killed in 1996–97 and 48 females were killed in 1997–98, compared to the previous 5-year mean of 61.2 females.

Mean total skull sizes of male bears harvested in both 1996–97 and 1997–98 was 24.7", differing only slightly from the mean skull size of 24.9" for the previous 5 years. Skulls from harvested females showed even less variation, averaging 21.7 in 1996–97, 21.8 in 1997–98, and 21.8 for the previous 5 years (Table 4). The mean age of bears harvested in 1996–97 was 7.5 years (5-year $\bar{x}$ = 7.7 years) for males and 7.9 years (5-year $\bar{x}$ = 7.4 years) for females. Age data for 1997–98 are not yet available.

A sex/skull restriction for guided nonresident hunters in permit hunts nr. 108–138 to 116–146 became effective in the spring 1995 season. Guided hunters in those areas must harvest male bears or females with skulls that are at least 15" long or 9" wide. Failure to meet these minimum requirements results in loss of a permit during the next season. Since inception of the regulation, the average annual harvest in the affected area has declined from 53.3 (1988–89 to 1993–94) to 47.7 (1995–96 to 1997–98). Nonresident harvest declined sharply from a mean of 30.2 bears (1988–89 to 1993–94) to 21.7 bears (1995–96 to 1997–98). Nonresident success also declined from 68% (1988–89 to 1993–94) to 55% (1995–96 to 1997–98). The regulation was effective in reducing harvest of female bears by nonresidents. Prior to the restrictions, the average nonresident harvest was 7.8 females/year (1988–89 to 1993–94), after restrictions this average fell to 2.3 females/year (1995–96 to 1997–98). Since 1995, 3 permits have been lost because of undersized females being taken.

Permit Hunts. There are 29 drawing hunt areas in Unit 8 for brown bears. Each year 319 drawing permits are available to Alaska residents (107 in fall, 212 in spring), and 153 permits are available for nonresidents (53 in fall, 100 in spring). Nonresidents hunting with resident relatives are allocated permits from the resident quota. Nonresident-guided permits may be reduced if hunters fail to adhere to sex/skull minimums. In 1996–97, 339 drawing permits were picked up by successful applicants. We issued 366 permits in 1997–98 (Table 5).

The northeastern portion of Kodiak Island is managed as a registration area for bear hunters (RB 230/260). The seasons mirror those in the drawing hunt areas, but there are no limits on the number of permits available. In 1996–97 we issued 166 registration permits, and in 1997–98 we issued 208 (Table 6). The mean number of registration permits issued in the previous 5 years was

168.4/year. The number of hunters afield in the registration hunt was 100 in 1996–97 and 105 in 1997–98, comparable to the mean of the previous 5 years (109.4).

Hunter Residency and Success. Hunter success in the drawing permit hunts was 45% in 1996–97 and 50% in 1997–98 (Table 5), comparable to the mean for the previous 5 years (48.2%). In the registration hunts, hunter success was 12% in 1996–97 and 8% in 1997–98, somewhat higher than the mean for the previous 5 years (7.6%).

Although over two-thirds of the drawing permits and the vast majority of registration permits are issued to Alaska residents, nonresidents usually harvest more bears in Unit 8 than do residents. In 1996–97, residents harvested 73 bears and nonresidents took 89 (Table 7). In 1997–98, residents harvested 83 bears and nonresidents took 83 bears. The mean harvest for the previous 5 years was 72.4 for residents and 88.0 for nonresidents.

Harvest Chronology. The first third of the fall season (October 25 to November 6) and the last third of the spring season (May 8 to 15) were typically the most productive times for bear hunters (Table 8). In 1996–97, 81% of the harvest occurred during the first third of the fall season, and in 1997–98, 77% of the harvest occurred in the first third. During the previous 5 years, the mean annual percentage of the harvest in the first third of the fall season was 73.0%. In 1996–97, 54% of the harvest occurred during the last third of the spring season, and in 1997–98, 46% of the harvest occurred in the last third. The 1997–98 season was the only time during the previous 10 years that the middle third of the season had the highest number of bears harvested. The mean annual percentage of the harvest in the last third of the fall season during the previous 5 years was 56.0%.

Transport Methods. Bear hunters in Unit 8 most commonly use aircraft and boats. The proportion of hunters reporting each method varies each year, with aircraft the most common transportation method (Table 9). This annual variation may be more a function of what hunters report rather than actual changes in transportation modes. Most hunters fly into hunt areas and then use a skiff or inflatable raft in the area, and hunters are inconsistent in the way they choose to report these overlapping modes of transportation.

Other Mortality

Defense of life or property (DLP) kills, illegal kills, subsistence harvests, and other nonhunting human-caused mortality resulted in the death of 20 bears in 1996–97 and 16 in 1997–98 (Table 3). This was comparable to the mean annual nonsport harvest of 16.4 bears/year during the previous 5 years.

The incidence of illegal or unreported DLP kills is unknown, but bears that have been shot but not reported are occasionally found, most frequently near the villages of Larsen Bay, Old Harbor, and Port Lions. Cases in which deer hunters, hikers, sport fishers, commercial fishers, photographers, and remote area residents killed or wounded bears without reporting the incidents have been documented often enough to warrant continued effort to improve our estimates of unreported kills.

HABITAT

Assessment

Most brown bear habitat is undeveloped, and people only seasonally occupy brown bear habitats. There are approximately 3 million acres of brown bear habitat on Kodiak, Afognak, and adjacent islands in Unit 8. Nearly half that acreage is contained within the Kodiak NWR. More than 300,000 acres of the original 1.8 million acres of refuge land, mostly prime coastal and riparian brown bear habitat, was transferred to Native corporations through ANCSA. These corporations are developing cabins and lodges close to brown bear concentrations on salmon streams and selling small parcels of land in important coastal brown bear habitat. The FWS has made considerable progress in negotiating conservation easements and in buying back refuge lands. Nearly 165,000 acres were purchased in 1996 from 3 Native corporations, and 57,000 acres of conservation easements were secured. In 1994 a parcel of Native corporation land on northeastern Afognak Island was purchased and returned to public ownership as mitigation for the Exxon Valdez oil spill. Several small parcels on Kodiak Island were also purchased from individuals recently by the FWS. Current developments with impacts on brown bears include ongoing commercial timber harvest on Afognak Island, proposed development of the Watchout Creek hydroelectric project, expanding rural settlement, commercial fishing, and increasing recreational activities in remote areas, including hunting, sport fishing and wildlife viewing.

Resource management agencies, private landowners, and local government need to commit serious efforts toward planning land developments that assure maximum compatibility with bears. Maintaining optimal brown bear populations is economically important to the tourist industry, including hunters and wildlife viewers. The Kodiak NWR has addressed many of these issues in their planning efforts, proposing extensive regulations to minimize human impacts in important bear habitat (FWS 1987).

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Nuisance bear problems in the 5 remote villages and near Kodiak city are exacerbated by inadequate garbage disposal. Improperly maintained landfills continue to attract bears to villages, resulting in several DLP bear kills annually. The Kodiak Island Borough installed an electric fence around the Kodiak landfill in June 1998, and there are plans to construct similar fences around landfills at other villages around the island in 1999. We intend to work with the Borough to evaluate the success of the fences in deterring scavenging by brown bears.

Developing environmentally sound and economical garbage disposals will require a multiagency approach and close cooperation with local and village governments. Larsen Bay village installed an oil-fired incinerator for garbage in 1993, but the facility has not been fully utilized. The high incidence of bears near Larsen Bay can be attributed to the continued attraction of bears to an unmanaged landfill. Reductions in staff and budgets of the Department of Environmental Conservation have hampered that agency's efforts to enforce waste disposal regulations.

Greater commitment to providing public educational programs about bear/human conflicts and bear ecology and management is a desirable long-term goal. Such programs would especially benefit deer hunters by reducing hunter/brown bear confrontations. Every year as deer hunters camp and hunt, they unnecessarily kill many brown bears.

Brown bear viewing and photography is a rapidly developing component of the summer tourism industry in Kodiak. A trial bear-viewing program, modeled after the McNeil River Sanctuary program, was administered by the FWS at Dog Salmon River in 1990 and 1991 and at O'Malley River in 1992 and 1994 (Smith 1995). The O'Malley program was cancelled after 1994 because of a legal challenge to the procedures used in awarding the bear-viewing concession to Munsey's Bear Camp. There are now no Kodiak NWR sanctioned bear-viewing programs on the refuge; however, some Kodiak-based air taxi services offer bear-viewing trips on Kodiak and to the Alaska Peninsula, and several lodges and outfitters cater to viewers and photographers. In 1995 a private operator began a guided bear-viewing program on Koniag Corporation land at Thumb River on Karluk Lake. The Dog Salmon River fish pass near Frazer Lake remains a popular site for unguided bear viewers. A local outfitter has been guiding bear viewers at the lower falls on Dog Salmon River since 1994.

CONCLUSIONS AND RECOMMENDATIONS

Bear harvests have been relatively consistent over the past 20 years with most variations attributable to weather and hunter participation. In 1996–97 and 1997–98, the percent males in the harvest was the highest reported in the past 37 years. In 1996–97 the number of females harvested was the lowest since 1970–71. The management objective of males composing at least 60% of the harvest has been achieved for the past 11 consecutive years and in 30 of 38 years since statehood. The current estimated annual harvest rate of 5.5% of the total bear population closely approximates the 5.7% exploitation rate from population simulation studies that Miller (1990*b*) suggested approximates the maximum exploitation rate for brown bears in Southcentral Alaska. These data indicate that the brown bear population in Unit 8 is healthy, productive, and relatively stable and that the current rate of harvest is sustainable as long as habitat is protected and the number of adult females killed remains low.

The minimum skull size requirement in permit hunts DB108/138–116/146 has resulted in a 11% decline in total harvest, a 19% decline in nonresident hunter success, and a 71% decline in the harvest of females by nonresidents in that area. These data indicate that nonresident hunters and their guides have become highly selective because of the risk of losing a permit if a bear fails to meet minimum requirements. Overall, there are few complaints about the system, and most hunters and guides seem to prefer the sex/skull restrictions as an alternative to reductions in the number of permits.

Intensive aerial surveys and composition counts along streams in southern Kodiak Island are now included in the Kodiak NWR annual management budget, and we plan to cooperate with conducting these surveys each year. Data from these surveys will allow us to monitor trends in the bear populations and refine population estimates.

There is a strong desire among a variety of user groups to revisit our bear management objectives for Unit 8 and develop a formal bear management plan. Kodiak NWR, bear hunting guides, and the nonprofit conservation organization Wildlife Forever have requested that the department take the lead in the planning effort. I feel that it would be appropriate for us to accept the lead role in developing a plan; however, it must be done systematically. If sufficient resources are available (financial and personnel), initial planning efforts would entail gathering all available data on the

Unit 8 bear population, its environment, and the human uses of bears and their habitats. Once these data are compiled, a professional planner should be tasked with gathering the stakeholders and formulating the actual plan.

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PREPARED BY:

Lawrence J. Van Daele
Wildlife Biologist III

SUBMITTED BY:

Mike McDonald
Wildlife Biologist III

Table 1 Estimated density and observation rates of independent bears in intensive aerial survey areas, Unit 8, 1987–1997

Survey Area	Year	Replicate Surveys	Survey Rate (min/km^2)	Bears/hr	Bears/100km^2	Sightability	Density Bears/1000 km^2	Size of survey area (km^2)	Size of survey area (mi^2)
Terror Lake	1987	3	1.5	3.1	7.5	0.33	234	355	137
Terror Lake	1997	4	1.7	3.4	9.2	0.33	276	355	137
Southwest Kodiak	1987	4	1.5	3.5	8.8	0.41	218	632	244
Sturgeon River	1992/93	4	1.8	2.6	7.7	0.41	190	264	102
Aliulik Peninsula	1992/93	8	1.6	4.0	10.8	0.53	216	350	135
Olga Lakes	1992/93	5	1.2	1.8	3.3	0.41	80	262	101
Karluk Lake	1994	4	2.1	5.4	18.0	0.45	400	267	103
Spiridon Lake	1995	4	1.9	1.2	4.0	0.33	118	290	112
Shearwater Pen.	1996	3	2.2	2.6	9.2	0.37	248	274	106
Kiliuda Bay	1996	4	2.5	2.4	10.1	0.37	270	159	61

Table 2 Unit 8 aerial stream counts of brown bears[a], 1985–1997

Regulatory year	Complete surveys	*Single bears* Number	%	*Maternal bears* Number	%	*Yearlings & cubs* Number	%	*Cubs of the year* Number	%	Total
1985	10	434	54	110	14	189	24	67	8	800
1986	10	445	55	115	14	191	24	54	7	805
1987	8	205	53	58	15	92	24	31	8	386
1988	4	117	51	39	17	50	22	23	10	229
1989	9	406	46	148	17	284	32	54	6	892
1990	8	460	44	177	17	273	26	126	12	1,036
1991	9	529	52	156	15	210	21	129	13	1,024
1992	5	226	44	92	18	103	20	92	18	513
1993	6	244	47	88	17	119	23	67	13	519
1994	--	---	---	---	---	---	---	---	---	---
1995	4	230	46	86	17	136	27	49	10	501
1996	3	122	39	62	20	86	27	45	14	315
1997	7	195	37	112	21	128	24	92	17	527

[a] From Kodiak National Wildlife Refuge files; standardized low-level surveys along selected streams on southwestern Kodiak Island.

Table 3 Reported brown bear kill data for the Kodiak archipelago by regulatory year and season, 1960/61–1997/98

Regulatory	Fall harvest				Spring harvest				Total sport harvest					Reported non-sport				Total reported bear kill[a]			
year	M	F[c]	UNK[d]	Total[c]	M	F	UNK	Total	M	%M[f]	F	UNK	Total	M	F	UNK	Total	M	F	UNK	Total
1960/61				0	72	25	0	97	72	74%	25	0	**97**	2	1	0	3	74	26	0	**100**
1961/62	19	17	0	36	55	23	0	78	74	65%	40	0	**114**	0	0	0	0	74	40	0	**114**
1962/63	17	16	0	33	50	37	4	91	67	54%	53	4	**124**	4	4	0	8	71	57	4	**132**
1963/64	21	9	0	30	69	45	1	115	90	62%	54	1	**145**	10	7	0	17	100	61	1	**162**
1964/65	23	6	0	29	67	67	3	137	90	54%	73	3	**166**	9	13	0	22	99	86	3	**188**
1965/66	40	26	0	66	77	62	1	140	117	57%	88	1	**206**	14	11	0	25	131	99	1	**231**
1966/67	40	22	1	63	45	31	1	77	85	61%	53	2	**140**	6	4	0	10	91	57	2	**150**
1967/68	30	16	0	46	50	27	0	77	80	65%	43	0	**123**	3	3	0	6	83	46	0	**129**
1968/69	16	12	0	28	32	16	1	49	48	62%	28	1	**77**	3	1	0	4	51	29	1	**81**
1969/70	11	9	1	21	36	21	6	63	47	56%	30	7	**84**	2	0	0	2	49	30	7	**86**
10-year mean	*24.1*	*14.8*	*0.2*	*39.1*	*55.3*	*35.4*	*1.7*	*92.4*	*77.0*	*60%*	*48.7*	*1.9*	***127.6***	*5.3*	*4.4*	*0*	*9.7*	*82.3*	*53.1*	*1.9*	***137.3***
1970/71	28	12	1	41	47	17	2	66	75	70%	29	3	**107**	5	8	0	13	80	37	3	**120**
1971/72	27	21	2	50	62	31	0	93	89	62%	52	2	**143**	1	2	1	4	90	54	3	**147**
1972/73	33	33	0	66	66	47	1	114	99	55%	80	1	**180**	0	1	1	2	99	81	2	**182**
1973/74	24	38	0	62	52	35	0	87	76	51%	73	0	**149**	2	1	1	4	78	74	1	**153**
1974/75	29	23	0	52	48	25	3	76	77	60%	48	3	**128**	1	5	0	6	78	53	3	**134**
1975/76	18	14	0	32	61	29	0	90	79	65%	43	0	**122**	2	6	0	8	81	49	0	**130**
1976/77	25	16	0	41	55	34	0	89	80	62%	50	0	**130**	1	0	0	1	81	50	0	**131**
1977/78	22	12	0	34	65	38	0	103	87	64%	50	0	**137**	1	3	1	5	88	53	1	**142**
1978/79	22	13	0	35	49	39	1	89	71	57%	52	1	**124**	6	2	2	10	77	54	3	**134**
1979/80	18	18	0	36	77	34	1	112	95	64%	52	1	**148**	1	3	4	8	96	55	5	**156**
10-year mean	*24.6*	*20.0*	*0.3*	*44.9*	*58.2*	*32.9*	*0.8*	*91.9*	*82.8*	*61%*	*52.9*	*1.1*	***136.8***	*2.0*	*3.1*	*1.0*	*6.1*	*84.8*	*56.0*	*2.1*	***142.9***
Regulatory	Fall harvest				Spring harvest				Total sport harvest					Reported non-sport				Total reported bear kill[a]			
year	M[b]	F[c]	UNK[d]	TOT[c]	M	F	UNK	Total	M	%M[f]	F	UNK	Total	M	F	UNK	Total	M	F	UNK	Total
1980/81	24	14	0	38	61	25	0	86	85	69%	39	0	**124**	3	6	3	12	**88**	**45**	**3**	**136**

Table 3 Continued

1981/82	21	16	0	37	65	34	0	99	86	63%	50	0	**136**	4	3	3	10	90	53	3	**146**
1982/83	36	26	2	64	102	36	0	138	138	68%	62	2	**202**	6	8	2	16	144	70	4	**218**
1983/84	31	26	0	57	102	36	0	138	133	68%	62	0	**195**	5	7	0	12	138	69	0	**207**
1984/85	33	21	0	54	71	30	0	101	104	67%	51	0	**155**	9	13	0	22	113	64	0	**177**
1985/86	52	32	2	86	70	34	0	104	122	64%	66	2	**190**	6	13	5	24	128	79	7	**214**
1986/87	26	39	0	65	71	30	0	101	96	58%	69	0	**165**	7	8	2	17	103	77	2	**182**
1987/88	25	25	0	50	80	40	1	121	104	61%	65	1	**170**	7	5	4	16	111	70	5	**186**
1988/89	30	23	1	54	73	39	0	112	103	62%	62	1	**166**	2	15	5	22	105	77	6	**188**
1989/90	25	20	0	45	74	32	0	106	99	66%	52	0	**151**	2	11	1	14	101	63	1	**165**
10-year mean	*30.3*	*24.2*	*0.5*	*55.0*	*76.9*	*33.6*	*0.1*	*110.6*	*107.0*	*65%*	*57.8*	*0.6*	***165.4***	*5.1*	*8.9*	*2.5*	*16.5*	*112.1*	*66.7*	*3.1*	***181.9***
1990/91	30	21	0	51	69	29	0	98	99	66%	50	0	**149**	6	7	3	16	105	57	3	**165**
1991/92	25	16	1	42	72	40	2	114	97	62%	56	3	**156**	6	6	4	16	103	62	7	**172**
1992/93	39	23	1	63	74	39	1	114	113	64%	62	2	**177**	5	7	6	18	118	69	8	**195**
1993/94	35	19	0	54	78	30	1	109	113	69%	49	1	**163**	2	6	8	16	115	55	9	**179**
1994/95	42	15	0	57	65	33	0	98	107	69%	48	0	**155**	10	14	3	27	117	62	3	**182**
1995/96	29	20	0	49	67	36	0	103	96	63%	56	0	**152**	2	2	1	5	**98**	58	1	**157**
1996/97	33	15	0	48	92	22	0	114	125	77%	37	0	**162**	5	7	8	20	130	44	8	**182**
1997/98	36	17	0	53	85	28	1	114	121	72%	45	1	**167**	7	3	6	16	128	48	7	**183**
8-year mean	*33.6*	*18.3*	*0.3*	*52.1*	*75.3*	*32.1*	*0.6*	*108.0*	*108.9*	*68%*	*50.4*	*0.9*	***160.1***	*5.4*	*6.5*	*4.9*	*16.8*	*114.3*	*56.9*	*5.8*	***176.9***

[a] reported kill data derived from sealing records (1960/61 to 1989/90) and annual harvest reports (1990/91 to present).
[b] males
[c] females
[d] unknown or unreported sex
[e] total
[f] percent males in harvest (males/total)

Table 4 Total skull size, age, and sex of brown bears killed by sport hunters in Unit 8, 1980/81–1997/98

	Males				Females			
Regulatory year	Mean skull size	*n*	Mean age	*n*	Mean skull size	*n*	Mean age	*n*
1980/81	24.0	93	6.2	101	21.6	45	6.9	48
1981/82	24.2	78	6.5	79	21.7	39	7.1	39
1982/83	24.4	89	7.2	98	22.1	55	8.6	59
1983/84	24.6	128	7.4	130	21.6	60	7.9	62
1984/85	24.7	99	7.3	102	22.0	45	7.8	51
1985/86	24.5	116	7.4	120	21.9	57	7.2	64
1986/87	24.8	93	7.6	96	21.9	60	8.5	64
1987/88	24.6	100	6.7	104	21.8	63	6.6	65
1988/89	25.5	98	9.1	103	21.6	53	7.4	61
1989/90	25.4	96	9.0	97	21.6	48	8.7	52
1990/91	25.3	97	8.6	95	21.7	43	8.0	50
1991/92	25.0	91	8.4	96	21.7	52	8.0	56
1992/93	25.1	106	8.2	112	21.9	56	7.8	61
1993/94	24.4	109	6.8	113	21.8	45	7.2	48
1994/95	25.0	103	7.8	107	21.8	46	6.8	48
1995/96	25.2	94	7.5	95	21.8	50	7.4	55
1996/97	24.7	120	7.5	125	21.7	34	7.9	37
1997/98	24.7	117	--[a]	--[a]	21.8	42	--[a]	--[a]

[a] Spring 1998 age data are not yet available

Table 5 Unit 8 brown bear harvest data for drawing permit hunts DB 101–159 and 201–259, 1988/89–1997/98

	Regulatory year	Permits issued	Permits returned	Percent did not hunt	Percent successful hunters	Males	%	Females	%	Unk	Total[a] harvest
Fall hunts	1988/89[a]	139	139	6	38	28	57	21	43	1	50
(DB101-129)	1989/90	127	127	5	35	22	52	20	48	0	42
(DB201-229)	1990/91	124	123	2	43	30	59	21	41	0	51
	1991/92	119	119	8	33	21	58	15	42	1	37
	1992/93	128	127	4	46	35	63	21	37	0	56
	1993/94	118	118	3	47	34	64	20	36	0	54
	1994/95	118	116	2	48	39	82	15	28	0	54
	1995/96	113	113	2	40	29	65	16	35	0	45
	1996/97	120	119	5	39	32	73	12	27	0	44
	1997/98	131	128	2	50	33	67	16	33	0	49
Spring hunts	1988/89[a]	216	216	1	66	73	65	39	35	0	112
(DB131-159)	1989-90	234	232	6	46	70	69	32	31	0	102
(DB231-259)	1990/91	221	221	1	44	68	71	28	29	0	96
	1991/92	227	225	6	50	69	66	35	34	2	106
	1992/93	214	212	2	51	73	68	34	32	0	107
	1993/94	219	218	4	50	77	74	27	26	1	105
	1994/95	215	213	2	45	63	66	32	34	0	95
	1995/96	225	223	3	45	63	64	35	36	0	98
	1996/97	219	216	2	50	85	80	21	20	0	106
	1997/98	235	218	1	50	83	76	26	24	1	110

Table 5 Continued

	Regulatory year	Permits issued	Permits returned	Percent did not hunt	Percent successful hunters	Males	%	Females	%	Unk	Total[c] harvest
Combined	1988/89[b]	355	355	3	47	101	63	60	37	1	162
Fall and	1989/90	361	359	5	42	92	64	52	36	0	144
Spring Hunts	1990/91	345	344	1	43	98	67	49	33	0	147
(DB101-159)	1991/92	346	344	6	43	90	64	50	36	3	143
(DB201-259)	1992/93	342	339	3	49	108	66	55	34	0	163
	1993/94	337	336	4	49	111	70	47	30	1	159
	1994/95	333	329	2	54	102	69	47	31	0	149
	1995/96	338	336	3	46	92	64	51	36	0	143
	1996/97	339	335	7	45	117	78	33	22	0	150
	1997/98	366	346	3	50	116	74	42	26	1	158

[a] Harvest figures may differ from those in other tables because of differences in classification of illegal kills and unresolved discrepancies in hunter reports.

[b] Afognak Island group and part of northeastern Kodiak Island (Hunt areas DB127–129/227–229, DB157/159/257–259) first included.

[c] Includes 1 bear killed by a sport hunter without a permit (not included in success rate of permittees).

Table 6 Unit 8 brown bear harvest data for registration permit[a] hunt numbers RB 230 and RB 260, 1988/89-1997/98

	Regulatory year	Permits issued	Permits returned	Hunters afield	Percent did not hunt	Percent successful hunters	Males	%	Females	%	Unk	Total harvest
Fall Hunts	1988/89[b]	85	78	--	46	8	2	50	2	50	0	4
(RB230)	1989/90	88	80	--	43	6	3	100	0	--	0	3
	1990/91	54	51	--	30	0	0	--	0	--	0	0
	1991/92	110	108	--	40	6	4[c]	80	1	20	0	5[c]
	1992/93	103	102	71	30	10	4	67	2	33	1	7
	1993/94	86	86	48	44	2	1	100	0	0	0	1
	1994/95	69	65	52	20	4	2	100	0	0	0	3
	1995/96	71	68	37	48	11	0	0	4	100	0	4
	1996/97	84	83	47	43	9	2	50	2	50	0	4
	1997/98	114	98	71	24	4	3	100	0	0	0	3
Spring	1988/89[b]	50	41	--	22	0	0	--	0	--	0	0
Hunts	1989/90	55	51	--	41	13	4	100	0	--	0	4
(RB230)	1990/91	63	60	--	37	5	1	50	1	50	0	2
	1991/92	73	71	--	15	13	3	38	5	62	0	8
	1992/93	98	92	66	28	9	1	20	4	80	1	6
	1993/94	70	68	45	34	9	1	25	3	75	0	4
	1994/95	75	68	45	40	7	2	67	1	33	0	3
	1995/96	85	83	58	32	9	4	75	1	25	0	5
	1996/97	82	78	53	32	15	7	88	1	12	0	8
	1997/98	94	55	34	38	12	2	50	2	50	0	4

Table 6 Continued

	Regulatory year	Permits issued	Permits returned	Hunters afield	Percent did not hunt	Percent successful hunters	Males	%	Females	%	Unk	Total harvest
Combined	1988/89[a]	135	119	--	38	4	2	50	2	50	0	4
Fall and	1989/90	143	131	--	42	8	7	100	0	--	0	7
Spring	1990/91	117	111	--	34	3	1	50	1	50	0	2
Hunts	1991/92	183	179	--	30	9	7[c]	54	6	46	0	13[c]
(RB230	1992/93	203	194	137	29	9	5	45	6	55	2	13
& RB260)	1993/94	156	154	93	30	5	2	40	3	60	0	5
	1994/95	144	133	97	27	6	5	83	1	17	0	6
	1995/96	156	151	95	39	9	4	44	5	56	0	9
	1996/97	166	161	100	38	12	9	75	3	25	0	12
	1997/98	208	153	105	31	8	5	71	2	29	0	7

[a] No limit on the number of permits issued.

[b] Afognak Island group and part of northeastern Kodiak Island changed to a drawing permit hunts (DB227-229 & DB257 259).

[c] Includes 1 bear killed by a sport hunter without a permit (not included in success rate of permittees).

Table 7 Residency of successful brown bear hunters[a] in Unit 8, 1988/89–1997/98

Regulatory year	Local residents	(%)	Nonlocal residents	(%)	Nonresidents[c]	(%)	Total successful hunters
1988/89	71[b]	43	---	---	94	57	165
1989/90	11	7	49	33	90	60	150
1990/91	7	5	47	32	95	63	149
1991/92	14	9	53	34	88	57	155
1992/93	16	9	58	33	103	58	177
1993/94	6	4	66	40	91	56	163
1994/95	10	6	58	37	87	56	155
1995/96	20	13	61	40	71	47	152
1996/97	10	6	63	39	89	55	162
1997/98	12	7	71	43	83	50	166

[a] Permits required for all hunters; does not include sport hunters who killed bear without a permit, so may differ from other tables.

[b] Includes all Alaska residents.

[c] Includes the following successful non-residents guided by next-of-kin: 1988/89 – 4; 1989/90 – 1; 1990/91 – 2; 1991/92 – 0; 1992/93 – 1; 1993/94 – 1; 1994/95 – 1; 1995/96 – 3; 1996/97 – 1; and, 1997/98 – 3.

Table 8 Chronology of the brown bear harvest, by season and period, in Unit 8, 1988/89–1997/98

Regulatory yar	Fall Season							Spring Season							Regulatory Year Total[a]
	Oct 25–Nov 6		Nov 7–Nov 18		Nov 19–Nov 25		Fall Total	Apr 1–Apr 15		Apr 16–Apr 30		May 1–May 15		Spring Total	
	Nr	%	Nr	%	Nr	%	Nr	Nr	%	Nr	%	Nr	%	Nr	
1988/89	43	80	9	17	2	4	54	0	---	39	35	73	65	112	166
1989/90	32	71	10	22	3	7	45	1	1	35	33	70	66	106	151
1990/91	37	73	11	22	3	6	51	5	5	41	42	52	53	98	149
1991/92	28	67	9	21	5	12	42	2	2	48	42	64	56	114	156
1992/93	53	84	4	6	6	10	63	3	3	48	42	63	55	114	177
1993/94	42	78	10	19	2	4	54	6	6	46	42	57	52	109	163
1994/95	38	67	11	19	8	14	57	2	2	40	41	56	57	98	155
1995/96	34	69	13	26	2	4	49	1	1	40	39	62	60	103	152
1996/97	39	81	8	17	1	2	48	6	5	47	41	61	54	114	162
1997/98	41	77	8	15	4	8	53	3	3	59	52	52	46	114	167

[a] Totals may differ from those in other tables because of different classifications of illegal sport harvest.

Table 9 Unit 8 brown bear harvest[a] percent by transport method, 1988/89–1997/98

Regulatory Year	Percent of Harvest								
	Airplane	Horse	Boat	3- or 4-wheeler	Snow-machine	ORV	Highway vehicle	Unknown	*n*
1988/89	74	0	24	0	0	0	0	2	166
1989/90	73	1	21	1	0	0	1	4	151
1990/91	72	0	25	0	0	1	1	1	149
1991/92	51	0	41	0	0	1	7	0	156
1992/93	69	1	22	3	0	0	5	0	177
1993/94	72	0	40	2	0	0	1	0	163
1994/95	57	0	38	1	0	0	3	0	155
1995/96	70	1	23	3	0	1	2	0	152
1996/97	48	0	46	0	0	<1	5	0	162
1997/98	70	0	27	0	0	<1	2	0	167

[a] Permits were required for all hunters; however, illegal sport kills by hunters without permits are included in this table.

LOCATION

GAME MANAGEMENT UNIT: 9 (33,638 mi^2)

GEOGRAPHIC DESCRIPTION: Alaska Peninsula

BACKGROUND

The Alaska Peninsula is a premiere area for large brown bears, and the Board of Game has placed a high priority on maintaining the quality of this population. Because of relatively easy aircraft access and the high quality of bear trophies in the unit, an active guiding industry developed during the 1960s. As hunting pressure increased, several studies on brown bear ecology were initiated. During the late 1960s and early 1970s, Alaska Department of Fish & Game (ADF&G) engaged in research at McNeil River State Game Sanctuary to investigate reproductive biology and survival rates of brown bears (Glenn et al. 1976). A succession of graduate students from Utah State University studied bear behavior at McNeil River during the early 1970s. Sellers and Aumiller (1994) analyzed population data collected at McNeil River.

An intensive study was conducted during the early 1970s near Black Lake in the central portion of Subunit 9E. Three hundred and forty-four bears were captured and marked during 1970–75 to acquire information on reproductive performance, movements, and harvest rates. More recently, efforts have been directed at further analyzing the data from this study to better understand the population dynamics of an exploited bear population. In 1988 an interagency study was initiated at Black Lake to assess the current status of the bear population (Sellers and Miller 1991, Sellers 1994, Miller et al. 1997) and to make comparisons with conditions in the early 1970s. The 1989 *Exxon Valdez* oil spill (EVOS) led to another research project to assess damage to the brown bear population along the coast of Katmai National Park. This study continued under National Park Service (NPS) funding with the primary objective of measuring population parameters of an unhunted brown bear population (Sellers et al. 1993).

High harvests that coincided with poor salmon escapements in most drainages in 1972 and 1973 indicated that hunting seasons should be reduced. Harvest statistics and the high percentage of marked bears killed in the Black Lake area also supported a reduction in hunting. Emergency closures were declared for all of Unit 9 in the spring of 1974 and for the central portion of the Alaska Peninsula in the spring of 1975. At the spring 1975 board meeting, the present system of alternating seasons (open in the fall of odd-numbered years and the spring of even-numbered years) was adopted to keep harvests within the quota of 150 bears per year for the area south of the Naknek River. This system reduced harvests substantially from 1976 to 1981 and allowed the bear population to recover.

In 1984 the board abandoned the harvest quota (150 bears) for the area south of the Naknek River and endorsed more flexible objectives (Sellers and McNay 1984): (1) maintain maximum opportunity to hunt bears and avoid a drawing permit system; (2) continue both spring and fall hunts, maintain a desirable sex ratio in the bear population, and allow hunters to select either season; (3) maintain hunting seasons long enough so that severe weather would be unlikely to eliminate the entire season; and (4) handle chronic bear threats to villages through better

sanitation, public education, and, only as a last resort when other measures prove ineffective, through special permit hunts.

In the fall of 1988, the Alaska Supreme Court ruled the exclusive guide area system unconstitutional. This allowed the number of registered guides operating in Unit 9 to increase; however, federal land management agencies limited the number of commercial-use licenses to new guides on federal lands. Therefore, most new guide operations used either state or private lands. With over 70% of the Unit 9 harvest coming from guided hunts, stability in the guide industry is a key part of the management program.

MANAGEMENT DIRECTION

Management Objectives

To maintain a high bear density with a sex and age structure that will sustain a harvest composed of 60% males, with 50 males 8 or more years old taken during the combined fall/spring season.

METHODS

Historically, brown bear managers have relied heavily on interpretation of harvest statistics (i.e., total harvest, sex ratio, age composition) to monitor bear populations. In recent years some attention has been given to using various computer models (Tait 1983, Harris 1984) to aid in evaluating usefulness of harvest data. However, models based on harvest data have inherent problems (Miller and Miller 1990). Recently a new model using the Lotka equation has been developed by W. Testa (ADF&G, Anchorage) to estimate the sustainable harvest of females based on estimates of survival and reproductive rates.

Despite the potential utility of models, supplementary means of detecting changes in heavily exploited bear populations are needed. Aerial surveys of bears concentrated along salmon streams have been used periodically since 1958, primarily to detect major changes in population composition. Erickson and Siniff (1963) identified limitations of these surveys, recommending procedures to standardize the technique. Subsequently, ADF&G has conducted surveys near Black Lake, and FWS has conducted surveys in the Izembek and Unimak areas.

In May 1999, an experimental line-transect/double count technique, first tried on Kodiak Island (Becker and Quang, in prep.), was used in the northern portion of Unit 9B in a cooperative project with the Lake Clark National Park to estimate brown and black bear densities; this project provided limited information on population composition.

RESULTS AND DISCUSSION

Population Status and Trend

The brown bear population in Unit 9 was depressed during the mid-1970s because of high harvests, low salmon escapements, and severe winters. With the reduced harvests during the late 1970s, bear densities have increased. From 1985 to 1990, the average annual count of independent bears at Black Lake was 102 (range = 86–109); from 1991 to 1996 the average

annual count was 121 (range = 101–144) (Sellers 1994). Poor weather in 1997 and 1998 hampered completion of adequate repetitions of these surveys, but one completed survey in 1998 included 158 independent bears. Four counts in 1999 averaged 162 independent bears. These data indicate a relatively stable population during the late 1980s, followed by an incremental increase during the 1990s.

Population Size

Brown bear densities vary within Unit 9; densities are lower in western Subunit 9B and the Bristol Bay coastal plain. Results from the 1989 CMR population estimate at Black Lake showed a density of 1 bear/2.08 mi^2 in a 469 mi^2 study area. Within the study area, density varied among count units from 1 bear/1 mi^2 to 1 bear/7 mi^2, depending on habitat type (Miller and Sellers 1992). Results were extrapolated by UCUs to arrive at estimates of 296, 879, 429, 3176, and 900 bears for 9A, 9B, 9C, 9E, and 9D, respectively (Sellers and Miller 1991). These estimates do not include National Park lands or McNeil River State Game Sanctuary. Thus, in the portion of Unit 9 open to brown bear hunting, the total population was estimated at 5679 bears in 1991, with an overall density of a bear/4.13 mi^2 (93 bears/1000 km^2) (Sellers and Miller 1991). Assuming that the bear population has grown since 1991, as suggested by stream surveys and opinions of various residents and guides, it is likely that the bear population now is close to 6000. I estimated that McNeil River State Game Sanctuary and national parks within Unit 9 contain an additional 2000–2500 brown bears.

Population Composition

Evidence from the Black Lake study and analysis of harvest data show a change in the population composition since the early 1970s believed to be correlated to differences in harvest rates. The Black Lake capture samples during the early 1970s showed an adult (i.e., ≥ 5 years old) sex ratio of 21 adult males:100 adult females. The 1988–89 capture sample showed a significantly higher ratio of 39 males:100 females (t = 1.62, df = 194, P = 0.052). The average age of adult males increased from a mean of 7.19 years in the early 1970s to 9.92 years in 1988 (Mann-Whitney, T = 87.5, P = 0.080) (Sellers 1994). The average age of adult females also increased from a mean of 9.57 years during the early 1970s to 12.21 years for 1988 (Mann-Whitney, T = 1345, P = 0.003).

Classification of bears during replicate stream surveys at Black Lake also showed changes in population composition believed to reflect significant changes in harvest rates beginning in the mid-1960s. This analysis was based on the percentage of "single" bears (i.e., not in family groups) in the population. Hunting regulations protected family groups of cubs and yearlings, so hunting tended to reduce the proportion of single bears in the population (Sellers and McNay 1984). During 1958–61, when harvests were extremely low, a mean of 46% (range = 37–55%) of 1365 brown bears classified during summer surveys were single bears. This was higher (t = 6.81, P = 0.002) than the mean of 21% single bears (range = 17–26%) for 2078 bears classified from 1967 to 1976 when the population was affected by excessive harvests. Restrictive regulations, beginning in 1974, led to reduced harvests, and the population began recovering during the late 1970s and early 1980s. During 1982–99, a mean of 37% of 11,108 bears classified during stream surveys were single, significantly higher than during 1967–76 (P = < 0.001)

I believe the circumstances of excessive harvests in the early 1970s and subsequent population recovery at Black Lake apply to Unit 9 in general (Sellers in prep).

In May 1999 we classified a total of 178 brown bears in the northern portion of Unit 9B, of which 64% were single bears. This high percentage probably reflects both low harvest pressure and the effect of 2 consecutive poor salmon runs in 1997 and 1998 that may have reduced productivity. The cohorts most likely affected by the scarcity of salmon were cubs and yearlings in 1999. The average litter size for cub and yearlings was 1.5 (n = 10) and 1.4 (n = 12). In contrast, the average litter size of offspring judged to be older than yearlings was 2.56 (n = 9).

MORTALITY

Harvest

Season and Bag Limit. The hunting season in Subunit 9C, Naknek River drainage, was 1 September–31 October and 1 May–30 June. The bag limit was 1 bear every 4 regulatory years by registration permit only.

The open season in Subunits 9A and 9B was 1–21 October in odd-numbered years and 10–25 May in even-numbered years. The season for the remainder of Unit 9, including the registration permit hunt in the Cold Bay road system, was 7–21 October in odd-numbered years and 10–25 May in even-numbered years. The bag limit was 1 bear every 4 regulatory years.

Board of Game Action and Emergency Orders. In March 1999 the Board of Game reviewed the status of brown bears in Unit 9 and deliberated over a large number of public proposals to liberalize the seasons. Based on evidence that the population was growing, the board extended the fall season in all subunits except 9A. In Unit 9B the fall season will run from 20 September to 21 October. In Units 9C, 9D, and 9E, the season was extended to 1–21 October.

The Cold Bay registration hunt in Subunit 9D continues to be closed routinely by emergency order after the quota is reached. Seasons were closed on 10 October 1997 and 19 May 1998.

Hunter Harvest. During the 1996–97 regulatory year, only the Naknek registration hunt was open; hunters took 7 bears in the fall and 9 in the spring. The reported harvest for the 1997–98 regulatory year was 553 bears, including 393 males (71%) and 160 females. I estimate the nonsport mortality at more than 50 bears. The combined 1997–98 harvest was the largest ever recorded. Nonbiological factors (e.g., weather and economic conditions affecting hunter participation) probably account for most of the annual fluctuations in harvests over the past 10 years.

During 1985–1992 and 1993–98, males accounted for 64% and 70% of the harvest, respectively. The mean annual harvest of trophy-sized males (i.e., ≥ 8 years old) has increased from 51 (range = 41–58) during the period of population recovery during 1975–82 to 73 (range = 61–80) during 1983–88 and to 120 during 1989–96. During 1997–98 146 males ≥ 8 years old were taken. Not only has the number of mature males in the harvest increased, but the proportion of the harvest composed of mature males has also increased for these 3 time periods: 14.3% during 1975–82; 16.9% during 1983–88; 23.4% during 1989–96, and 26.4% in 1997–98. It should be noted these

changes in harvest patterns occurred over a period when the hunting regulations were relatively stable.

Total harvest rate is estimated to be 5.4%, based on an estimate of 6000 bears in areas open to hunting (Sellers and Miller 1991), a mean calendar-year reported harvest of 276 for 1997–98, and an estimated 50 unreported DLP and illegal kills.

I used W. Testa's model as another approach to evaluate whether current harvest levels are sustainable. Input data included an estimated 2700 females in areas of Unit 9 open to hunting (derived by applying composition data from Black Lake [Sellers 1994] to the 1991 estimate of 5679 bears) and preliminary reproductive and survival rates from the Black Lake study (Sellers 1994). Testa's "model 1" estimated a sustainable harvest of 92 females per year. During the past 12 years, the mean annual harvest has been 85 females.

Permit Hunts. The registration permit hunt in the Naknek drainage was designed to minimize bear-human conflicts in the most heavily settled portion of Unit 9. Participation in fall hunts was higher than in spring hunts because some moose and caribou hunters obtained a permit "just in case" they encountered a bear. During the 1996 regulatory year, 7 bears were killed during the fall and 9 were killed during the spring hunt. During the 1997 regulatory year, 8 were killed during the fall and none was harvested during spring. During the 1998 regulatory year, 10 bears were killed during the fall and 2 were taken during the spring season. Since 1987, about half the bears taken in this permit hunt were either confirmed or suspected of having been in conflict with humans.

The registration permit hunt in the Cold Bay area was also designed to minimize bear-human conflicts. In 1983, the INWR staff expressed concern that the number of local brown bears was too low; they believed problem bears were not common. Consequently, the Board of Game only authorized this hunt when it was determined that problem bears were present. The hunt was not conducted from 1984 until fall 1989. During this period, the bear population appeared to have increased, and the FWS and the department agreed it was impractical to have a season by emergency announcement in response to nuisance bear complaints. Thus, the registration permit hunt was changed to coincide with the normal unitwide season, with a seasonal quota of 2 bears or a regulatory year quota of 4 bears. Both the fall 1997 and spring 1998 seasons were closed by emergency order after 2 bears had been taken.

The Chignik Brown Bear Management Area was established in 1994 and was modeled after the Western Alaska Brown Bear Management Area to provide an opportunity for traditional subsistence hunting. Past village household surveys resulted in customary and traditional findings for the villages of Chignik Lake, Perryville, and Ivanof Bay. This hunt overlaps a federal subsistence permit hunt, which complicates the issuing permits and collecting results. Since 1996, participation and compliance with this permit hunt have been virtually nil. The Subsistence Division estimated a harvest of 6 bears from these villages in 1996, yet the only permittee was unsuccessful.

Unit 9B was included in the Western Alaska Brown Bear Management Area in 1997. Since then only 3 bears have been reported taken in the unit.

Hunter Residency. During the 1997–98 general season, nonresidents took 78% of the harvest. This is slightly above the long-term average.

Harvest Chronology. Prior to 1985, the fall season began on 7 October. When the opening date was moved to 1 October, the pattern of harvest also shifted, and 47% of the fall harvest occurred during the first 6 days of October during 1985–89. The opening date for the general season in 9C, 9D, and 9E was moved back to 7 October in 1991, but again advanced to 1 October for the 1999 season.

Transportation Methods. During the 1995–96 season, 77% of the successful hunters used aircraft, with boats being the next most common method of transportation (Table 6). The use of boats has increased gradually over the past 4 general seasons.

Other Mortality

Nonhunting and illegal kills, including DLP kills, are rarely reported. Unsubstantiated reports from villages, remote lodges, canneries, and commercial fishermen suggest that many other unreported bears are killed or wounded, and I estimate the total unreported kill at 50–100 bears per year.

Preliminary estimates of survival rates (excluding hunter kills) from the Black Lake study indicated natural mortality was a significant factor for females and young bears. During the 9 years of this study, annual survival rates for cubs, yearlings, and subadult females, and adult females were 0.57, 0.88, 0.90, and 0.92, respectively (Sellers in prep).

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Bear-human conflicts continue to be the most serious and intractable problem in Unit 9, as in many other parts of the state. Given the pervasive nature of this problem, it will take a concerted effort to make headway.

CONCLUSIONS AND RECOMMENDATIONS

Brown bear populations do not lend themselves to convenient methods to monitor trends in density or composition. Harvest statistics are useful, but a manager cannot expect to gain a confident appraisal of population status solely from sex and age composition of the harvest. Stream surveys on the Alaska Peninsula should be continued. The Black Lake surveys indicated a relatively stable and high population. Harvests increased significantly during the 1980s, and the population appears to have stopped growing. I estimate that 5679 bears inhabit Unit 9. During 1994–96, the calendar-year kill from all sources has averaged 261 bears. Combining the average reported kill with an estimated unreported illegal/DLP kill of 50 bears per year results in an annual harvest rate of 5.5%.

At this time I do not recommend establishing harvest guidelines based on extrapolated population estimates for each subunit. It appears Subunit 9B can sustain an increased harvest, but population estimates for this area are crude and harvests are increasing.

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PREPARED BY:

Richard A. Sellers
Wildlife Biologist III

SUBMITTED BY:

Mike McDonald
Assistant Management Coordinator

Tables corresponding to Unit 9 data (Pages 102–105) were not submitted with the Unit 9 report. Data from these tables will be included in the 2001 brown bear report.

LOCATION

GAME MANAGEMENT UNIT: 10 (1536mi^2)

GEOGRAPHIC DESCRIPTION: Unimak Island

BACKGROUND

Unimak Island is the only area in Unit 10 occupied by brown bears. The island is classified as a wilderness area and is managed by the Izembek National Wildlife Refuge (INWR). Brown bear hunting on Unimak Island was administered by the U.S. Fish and Wildlife Service (FWS) from 1949 to 1979 and by the department after 1979. Fifteen drawing permits are issued each year; 7 for the spring hunt and 8 for the fall hunt.

MANAGEMENT DIRECTION

MANAGEMENT GOAL

Provide opportunities to hunt large brown bears under aesthetically pleasing conditions. The number of hunters is limited, and harvests are maintained below maximum-sustained yield.

MANAGEMENT OBJECTIVE

Maintain a high bear density with a sex and age structure that will sustain a harvest of at least 60% males.

METHODS

The FWS periodically conducts aerial bear surveys on Unimak Island in late summer. Interpretation of harvest data to reflect population status is not possible with the very low number of bears killed annually.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The Unimak Island brown bear population appears to be maintained by natural limiting factors at a relatively stable level.

Population Size

Brown bear population size and density were not specifically evaluated on Unimak Island. Results of past surveys and extrapolation of density estimates made elsewhere in Alaska indicated that over 250 bears inhabited the island.

MORTALITY

Harvest

Season and Bag Limit. The open seasons for residents and nonresidents were 1 October–31 December and 10–25 May. The bag limit was 1 brown bear every 4 regulatory years by drawing permit only; 15 permits were issued annually.

Board of Game Action and Emergency Orders. None

Hunter Harvest. During 1981–96, annual harvests from Unimak Island averaged 5.9 bears (range = 3–9). During the 1997–99 regulatory years, the average annual harvest was 12.7 bears. Males composed 73% of the harvest during 1981–96 regulatory years and 76% during 1997–99.

Hunter Residency and Success. Nonresidents accounted for 8% of the harvest during 1981–96 and 54% during 1997–99.

Approximately 38% of permittees did not hunt on Unimak Island between 1981 and 1996, and of those who actually hunted, 63% were successful. Since 1997, 89% of permittees hunted and their success rate increased to 90%.

Harvest Chronology. Total harvests have been relatively evenly split between the spring and fall seasons. Since 1994 when the Board of Game extended the fall season through the end of December, 4 hunters have killed bears after October.

Transport Methods. Since 1995 all successful hunters used aircraft to access Unimak Island.

CONCLUSIONS AND RECOMMENDATIONS

The brown bear population on Unimak Island appears stable, and the drawing permit hunt meets management objectives. Although harvests have increased in recent years, I do not recommend changes in the permit hunt at this time, except to cease issuing special permits for auction unless these permits are subtracted from the number issued through the normal drawing. In addition to continuing late summer aerial surveys flown by the INWR, I recommend using the new line transect population estimator developed by E. Becker on the entire island as soon as funding is secured.

PREPARED BY:
Richard A. Sellers
Wildlife Biologist III

SUBMITTED BY:
Mike McDonald
Wildlife Biologist III

Table 1 Unit 10 brown bear harvest data by permit hunt, 1995–99

Hunt Nr. / Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Harvest		
						Male	Female	Total
375 Fall Unit 10								
	1995–96	8	12	14	86	2	4	6
	1996–97	8	25	12	83	4	1	5
	1997–98	9[a]	0	0	100	4	5	9
	1998–99	8	12	12	86	6	0	6
	1999–00	8	25	0	100	6	0	6
376 Spring Unit 10								
	1995–96	7	57	0	100	3	0	3
	1996–97	7	28	14	80	3	1	4
	1997–98	7	0	43	57	1	3	4
	1998–99	7	14	0	100	6	0	6
	1999–00	8[a]	12	0	100	6	1	7
Totals for all permit hunts								
	1995–96	15	33	10	90	5	4	9
	1996–97	15	27	18	82	7	2	9
	1997–98	16	0	19	81	5	8	13
	1998–99	15	13	7	93	12	0	12
	1999–00	16	19	0	100	12	1	13

[a] Includes 1 governor's permit.

LOCATION

GAME MANAGEMENT UNIT: 11 (13,257 mi^2)

GEOGRAPHIC DESCRIPTION: Wrangell Mountains

BACKGROUND

Brown bears were numerous in Unit 11 prior to 1948–1953, when federal poisoning programs directed at controlling wolves incidentally reduced bear numbers. Following cessation of wolf control, bear numbers increased, and by the mid-1970s bears were abundant.

Brown bear harvests averaged 16 (range = 8–27) bears per year throughout the 1960s and 1970s but declined substantially after 1978, when much of Unit 11 was included in Wrangell-Saint Elias National Park and Preserve. Since 1979, hunting pressure has declined and harvests have averaged only 6 bears (range = 2–12) per year.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

To maintain a brown bear population that will sustain an annual harvest of 25 bears composed of at least 50% males.

METHODS

We monitored the brown bear harvest by sealing skulls and hides of harvested bears. We measured skulls of sealed bears and determined the sex of the bears. A premolar tooth was extracted for aging, and information on date and location of the harvest, days afield, and mode of transportation was collected from successful hunters.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population data were unavailable for brown bears in Unit 11 because surveys or censuses have not been conducted. Frequent observations of bears by department staff and the public suggested a relatively abundant and well-distributed population of brown bears. A population trend was not evident.

Distribution and Movements

Based on incidental observations and harvest locations, brown bears inhabit all habitats within Unit 11 except high elevation glaciers. There has not been a bear movement study conducted in Unit 11, but we suspect the movement patterns are similar to those in Unit 13. After den emergence, most bears, except females with cubs of the year (COYS), move into riparian areas to feed on sprouting plants and overwintered berries. They also scavenge carcasses of ungulates that died during winter. Females with COYS tend to stay at higher elevations to avoid contact with

other bears. Throughout the summer, brown bears in Unit 11 feed in many habitats. In late summer, bears generally move into subalpine habitats to feed on ripening blueberries. Bears feed on salmon in many streams throughout Unit 11 but especially in the lower Chitina River Valley during late summer and fall. Most brown bears in Unit 11 probably den at elevations >3500 feet with a preference for southern aspects.

MORTALITY

Harvest

Seasons and Bag Limits. The open seasons for resident and nonresident hunters in Unit 11 were 1 September to 31 October and 25 April to 31 May. The bag limit was 1 bear every 4 regulatory years.

Board of Game Actions and Emergency Orders. The board determined there was not subsistence use of brown bears in Unit 11 effective 1 July 1989. The National Park Service (NPS) adopted this board subsistence determination and closed all brown bear hunting in those portions of Unit 11 that were designated "park" (as opposed to "preserve"). The NPS position was that only subsistence hunting by local rural residents was allowed in the park. There has been no additional Board of Game action on Unit 11 brown bears since 1989.

Hunter Harvest. Two brown bears were reported killed during the 1996–97 season, and 4 were killed during 1997–98 (Table 1). The percentage of males in the harvest was at or above current management guidelines for both seasons. However, in recent years so few bears have been taken that the percent males in the harvest is considered neither a critical nor meaningful part of brown bear management in this unit. The mean age for males was 6.0 years in 1996–97 and 2.5 years in 1997–98. The mean age for harvested males over the past 10 years was 6.5 years.

Hunter Residency and Success. Nonresident hunters took 2 brown bears during the 1996–97 season and zero (0) bears in 1997–98 (Table 2). The annual harvest by nonresidents has declined from an average of 11 (range = 2–18) bears per year between 1961 and 1978 to an average of 2 per year (range = 0–3) since 1978. Local residents harvested no bears during the past 2 years. Successful bear hunters averaged 2.5 days hunting during the 1996–97 season and 3.3 days in 1997–98. Since 1979, hunter effort data show a mean of 4.9 days to take a bear in Unit 11.

Harvest Chronology. One hundred percent of the 1996–97 and 50% of the 1997–98 brown bear harvest occurred during the fall (Table 3). Since initiating sealing records in 1961, over 80% of the Unit 11 brown bear harvest occurred during the fall season, presumably because combination hunts for more than 1 species were possible. A noticeable exception was 1989–90 when 58% (n = 7) of the take occurred during the spring and was attributed to increased guiding activity that particular year. Spring harvests were higher in the 1970s when more guides were active in Unit 11.

Transport Methods. During the past few years, aircraft and 4-wheelers were the most important method of transportation, followed by highway vehicles (Table 4). In previous years more successful hunters reported using aircraft than any other method of transportation. Use of ground

transportation in Unit 11 is very restricted; the only access points are along the Nabesna or Chitina-McCarthy Roads.

Other Mortality

Two bears were reported taken in defense of life or property (DLP) in 1995, the first non-hunting means reported since 1990. Historically, nonhunting kills were all DLPs. Although much of the unit is remote with few cabins, most bear problems that result in the killing of a problem bear occur near homesites and cabins along the Nabesna and McCarthy Roads. More bears are probably killed each year than are reported because of the work involved with salvaging and preserving the hides and skulls of bears taken DLP. Compliance with reporting requirements on DLP bears would be higher if individuals were not required to salvage the hide and skull. Because most summer hides are worthless, DLP requirements could be changed so that during June, July, and August, only skulls and claws need to be surrendered. This would undoubtedly increase reporting compliance but might also increase DLP kills as the requirement to salvage the hide may often be a deterrent to killing bears.

HABITAT

Assessment

Few cabins or homesites are in this remote unit. Future settlement will be limited because much of the land is now included in Wrangell-St. Elias National Park. Private inholdings or Park Service facilities are the only source of development, especially along the McCarthy Road and at McCarthy. The number of people living and visiting McCarthy has increased appreciably in recent years and as a result, bear problems will become more frequent and result in more DLP-killed bears. Overall, Unit 11 is considered to be good brown bear habitat because of the variety of vegetation types, large tracts of undeveloped land, and numerous salmon streams throughout the unit.

CONCLUSIONS AND RECOMMENDATIONS

From 1961 to 1978, brown bear harvests averaged 16 bears per year; since 1979, harvests have averaged 7 per year. The declines in the total and nonresident harvests were the result of the establishment of Wrangell-St. Elias National Park and Preserve. National Park Service regulations prohibit sport hunting in portions of the unit designated as "park." From 1979 until 1989, subsistence hunting for brown bears by local residents was allowed in "park" designated areas. However, aircraft use was not allowed to access park areas, thus effectively closing most of the park to bear hunting. The NPS closed subsistence brown bear hunting in 1989 after the Alaska Board of Game determined that brown bears were not a customary and traditional animal for state subsistence in Unit 11. Aircraft access and sport hunting of brown bears were allowed and continue in areas designated as "preserve," which constitutes less than one-half of Unit 11.

The percent harvest of males has remained consistent since 1961, averaging 61%. This exceeded the management objective of maintaining a minimum of 50% males in the harvest. Sex composition, mean age, and skull sizes often fluctuate annually because of small sample size.

Generally, bears killed in Unit 11 were older and larger than those taken in adjacent Unit 13, where harvest rates were higher.

Brown bear harvests in Unit 11 have been low since 1979, and current harvests do not affect the brown bear population in the unit. I recommend no changes in season length or bag limit at this time.

Prepared by

Robert W. Tobey
Wildlife Biologist III

Submitted by

Michael G. McDonald
Assistant Management Coordinator

Table 1 Unit 11 brown bear harvest, 1993–98

Regulatory year	Hunter kill					Nonhunting kill[a]			Estimated kill[b] Unreported illegal		Total estimated kill					
	M	F	(%)	Unk	Total	M	F	Unk.			M	(%)	F	(%)	Unk.	Total
1993–94																
Fall 93	1	1	(50)	--	2	--	--	--	--	--	1	(50)	1	(50)	--	2
Spring 94	1	1	(50)	0	2	--	--	--	--	--	1	(50)	1	(50)	--	2
Total	2	2	(50)	0	4	0	0	0	1	1	2	(50)	2	(50)	2	6
1994–95																
Fall 94	1	3	(75)	0	4	--	--	--	--	--	1	(25)	3	(75)	0	4
Spring 95	1	1	(50)	0	2	--	--	--	--	--	1	(50)	1	(50)	0	2
Total	2	4	(67)	0	6	0	0	0	0	0	2	(33)	4	(67)	0	6
1995–96																
Fall 95	1	1	(50)	0	2	1	--	--	--	--	2	(67)	1	(33)	0	3
Spring 96	0	0	(0)	0	0	1	--	--	--	--	1	(100)	0	(0)	0	1
Total	1	1	(50)	0	2	2	0	0	0	0	3	(75)	1	(25)	0	4
1996–97																
Fall 96	1	1	(50)	0	2	0	--	--	--	--	1	(50)	1	(50)	0	2
Spring 97	0	0	(0)	0	0	0	--	--	--	--	0	(0)	0	(0)	0	0
Total	1	1	(50)	0	2	0	0	0	0	0	1	(50)	1	(50)	0	2
1997–98																
Fall 97	2	0	(0)	0	2	0	--	--	--	--	2	(100)	0	(0)	0	2
Spring 98	2	0	(0)	0	0	0	--	--	--	--	2	(100)	0	(0)	0	2
Total	4	0	(0)	0	4	0	0	0	0	0	4	(100)	0	(0)	0	4

[a]Includes Defense of Life or Property kills, research mortalities, and other known human-caused accidental mortality.

[b] Estimated kill by year, not by season.

Table 2 Unit 11 brown bear successful hunter residency, 1989–98

Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Successful hunters
1989–90	4	(33)	3	(25)	5	(42)	12
1990–91	2	(22)	6	(67)	1	(11)	9
1991–92	2	(67)	0	(0)	1	(33)	3
1992–93	2	(33)	2	(33)	2	(33)	6
1993–94	0	(0)	2	(50)	2	(50)	4
1994–95	0	(0)	4	(67)	2	(33)	6
1995–96	0	(0)	2	(100)	0	(0)	2
1996–97	0	(0)	0	(0)	2	(100)	2
1997–98	0	(0)	4	(100)	0	(0)	4

[a] Local resident means resident of Unit 13 or Unit 11.

Table 3 Unit 11 brown bear harvest chronology percent by month, 1989–98

Regulatory year	Harvest percent				
	September	October	April	May	*n*
1989–90	33	8	8	50	12
1990–91	89	--	--	11	9
1991–92	67	--	--	33	3
1992–93	50	17	--	33	6
1993–94	50	--	--	50	4
1994–95	67	--	--	33	6
1995–96	50	50	--	--	2
1996–97	50	50	--	--	2
1997–98	50	--	--	50	4

Table 4 Unit 11 brown bear harvest percent by transport method, 1989–98

Regulatory year	Percent of harvest									
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Walking	Unk.	*n*
1989–90	42	8	17	0	0	8	17	0	8	12
1990–91	44	0	0	0	0	11	33	0	11	9
1991–92	33	0	0	0	0	0	33	0	33	3
1992–93	33	0	33	0	0	0	33	0	0	6
1993–94	50	0	0	0	0	0	50	0	0	4
1994–95	50	0	0	50	0	0	0	0	0	6
1995–96	0	0	0	50	0	0	50	0	0	2
1996–97	100	0	0	0	0	0	0	0	0	2
1997–98	0	25	25	0	0	0	25	25	0	4

LOCATION

GAME MANAGEMENT UNIT: 12 (10,000 mi^2)

GEOGRAPHIC DESCRIPTION: Upper Tanana and White River drainages; includes the northern Alaska Range east of the Robertson River and the Mentasta, Nutzotin, and northern Wrangell Mountains

BACKGROUND

Grizzly bears are distributed throughout most of Unit 12. The only areas (approximately 2500 mi^2) not commonly used by bears are dominated by high mountains (>7000 ft), devoid of vegetation, or covered by large ice fields. Little is known about historical population trends, but based on harvest data, most of the unit probably supported densities of grizzly bears not limited by harvest. In those portions of the unit that were mined extensively or had human settlements, the bear population was regulated at lower levels.

Since 1900, grizzly bears have been actively sought by hunters and periodically by miners in southeastern Unit 12. Bear hunting regulations became more restrictive at the time of statehood until the early 1980s as guiding activity increased in the unit. During the 1970s, the unit's moose population declined substantially and grizzly bears were found to be an important predator on moose calves. Research from a Southcentral Alaska study indicated that when the grizzly bear population was reduced by at least 60%, moose calf survival increased significantly (Ballard and Miller 1990). In an attempt to obtain elevated moose calf survival in Unit 12, grizzly bear hunting regulations were liberalized in 1981 with the intent of reducing the bear population. During the 1980s and 1990s, grizzly bear harvest regulations were liberalized in other areas of Alaska to try to mimic the results of the Southcentral study, even though further analysis of the Southcentral data found no evidence that bear reduction contributed to the moose population increase (Miller and Ballard 1992).

During the mid-1980s, bear harvests increased by 29% in Unit 12 in response to the more liberal seasons and bag limits. Concurrently, the survival of moose calves to 5 months of age improved in eastern Unit 12, and the moose population throughout Unit 12 slowly increased. However, the relationship between increased calf survival and reduced grizzly bear numbers was still not known. Annual moose calf survival declined or remained stable during the early 1990s. Management objectives called for elevated grizzly bear harvests until moose numbers approached stated objectives or harvest levels were too high to ensure the viability of the bear population. During the 1990s it seemed that reducing the grizzly bear population by harvest was not having the desired effect on moose calf survival. In response, management objectives were changed to offer the greatest amount of hunting opportunity but still ensure protection of the unit's grizzly bear population.

MANAGEMENT DIRECTION

MANAGEMENT GOAL

- Provide maximum opportunity to participate in hunting grizzly bears in Unit 12.

MANAGEMENT OBJECTIVE

- Manage harvests so the 3-year mean harvest does not exceed 24 bears and has at least 55% males in the harvest.

METHODS

All grizzly bears taken in Unit 12 must be sealed before being transported from the unit. During the sealing process we take skull measurements, determine the sex of each bear, extract a premolar tooth, and collect information on date and specific location of harvest and time spent afield by the hunter. Premolar teeth were sent to Matson's Laboratory (Milltown, Montana USA) to be aged. Harvest data were summarized by regulatory year (RY = 1 July–30 June).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

I estimated the fall 1998 Unit 12 grizzly bear population was 350–425 bears (6.9–8.4 bears of all ages/1000 mi^2; 18.0–21.9 bears of all ages/1000 km^2) and the population trend was stable. My estimate was based on extrapolations from point estimate surveys conducted in similar type habitats in Interior and Southcentral Alaska (Reynolds and Boudreau 1992; Miller et al. 1997) and on harvest distribution and sex and age composition of the harvest. My estimate of population trend was based on harvest statistics (total harvest, sex ratio, average skull size, and age of harvested bears), informal public surveys, and questionnaires.

Based on harvest data, grizzly bear numbers were reduced in portions of Unit 12 due to high harvest between RY 1973–1974 and 1982–1983. During this period, annual harvests averaged 20.1 bears/year (s = 4.7), and the kill was primarily from the northern Wrangell Mountains, Mentasta Mountains, and the Tok River drainages. Much of Unit 12 is difficult to access and, consequently, harvest by residents is concentrated in the few accessible areas. Guides also hunt primarily in these areas but stay separate from resident hunters by using areas that have restricted access due to landownership patterns.

Between RY 1984–1985 and 1987–1988, grizzly bear numbers in accessible areas continued to decline due to increased harvest ($\bar{x}$ = 26 bears/yr, s = 6.1) that followed more liberal harvest regulations. Since RY 1987–1988 harvest declined to 15.1 bears/year (s = 4.9), but harvest distribution remained the same. Average skull sizes of harvested males were comparable between RY 1973–1974 through 1983–1984 (20.8 in, s = 1.1) and RY 1987–1988 through 1997–1998 (20.7 in, s = 0.59). Average skull size (19.6 in, s = 0.49) was smaller during RY 1984–1985 through 1987–1988. The primary difference between the periods was that from RY 1984–1985 through 1987–1988 no grizzly bear tag fee was required.

The estimated kill density ranged from 1.6 bears/10,000 mi^2 (4.1 bears/10,000 km^2) in the northern Wrangell and Mentasta mountains to 1.4 bears/10,000 mi^2 (3.6 bears/10,000 km^2) in the Tok River drainages. In Unit 20A a kill density of 0.8 bears/10,000 mi^2 (2.2/10,000 km^2) occurred during a period when the bear population declined by 28% (Reynolds, unpubl data). In Unit 20E the kill density averaged 1.3 bears/10,000 mi^2 (3.3/10,000 km^2) during a period when

the bear population declined by an estimated 29% (Gardner, unpublished). In the remainder of Unit 12 (5875 mi^2), the kill density averaged 0.2 bears/10,000 mi^2 (0.4 bears/10,000 km^2) and probably did not affect population trend. Based on total harvest, percent of females >5 years old, and harvest location during the past 3 years, the Unit 12 grizzly bear population was probably stable at a reduced level compared to the early 1970s. Comments received from long-term guides and hunters in the area support this assessment.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 12, 1 bear every regulatory year	1 Sep–31 May (General hunt only)	1 Sep–31 May

A bear taken in this unit did not count against the bag limit of 1 bear every 4 years in other units; however, no person could take more than 1 bear statewide per regulatory year. During the report period a $25 resident tag fee was required to hunt grizzly bears in Unit 12.

Board of Game Actions and Emergency Orders. No regulatory changes for grizzly bears in Unit 12 occurred during the report period. The tag fee requirement was waived in northern Unit 20D during spring 1995, which potentially could affect the grizzly bear numbers in adjacent northwestern Unit 12. Based on harvest distribution in Unit 20D, this regulatory change has had little effect on Unit 12 grizzly bears (DuBois, personal communication).

Hunter Harvest. Based on the estimated grizzly bear population size and research conducted in Unit 20A (Reynolds, personal communication), the Unit 12 sustainable harvest was 28 bears, of which 6 can be adult females (>5 years old). During the report period hunters reported taking 21 (RY 1996–1997) and 13 bears (RY 1997–1998), of which 4 and 1, respectively, were females older than 5 years (Table 1). The 3-year average harvest was 14.0 bears, and the range of the number of adult females in the harvest was 1–4. The percent males in the harvest during RY 1996–1997 and 1997–1998 were 57% and 85%, respectively, and the 3-year average was 72%. In 1998 the preliminary reported fall harvest was 10 bears (60% male).

The grizzly bear management objective in several areas of the state is to reduce bear numbers in an attempt to increase moose calf survival. In Unit 12, an assortment of season and bag limit requirements were tried to increase the grizzly bear harvest and cause a population decline. Increasing the bag limit to 1 bear/year in 1982 caused little change in harvest. During RY 1984–1985 and 1985–1986, the grizzly bear tag fee requirement was waived and harvest increased to 30 and 29 bears, respectively. The greatest increase in harvest was during spring 1984, indicating

the increase in harvest was not incidental to moose and caribou hunts, but was due more to advertising of the area and to the tag fee exemption.

In contrast to Unit 12, total harvest did not increase in adjacent Unit 20E when the tag fee requirement was waived. In Unit 20E the harvest increased significantly ($P = 0.001$) following a public awareness campaign and a change in the bag limit to 1 bear/year. However, in both units we found that even under these regulations harvest stabilized because hunter demand was eventually met. If further reduction of bear numbers through increased harvest is desired, there will need to be some other attractive moose or caribou hunt offered in the area, an intensive public awareness campaign, or additional changes in the bear harvest regulations that will attract new hunters to the area.

Hunter Residency and Success. Historically, nonresidents harvested most of the grizzly bears in Unit 12. Before RY 1982–1983, nonresident hunters took 63% of the harvested grizzly bears. During RY 1982–1983 through 1991–1992, resident harvest increased as a result of the regulation changes allowing 1 bear/year and, periodically, no tag fee. During that period, residents took 66% of the bear harvest. During spring 1991 the bag limit was changed back to 1 bear/4 years and resident harvest began to decline (Table 2). Since RY 1992–1993, nonresidents have taken 66% of the harvest even though more liberal regulations favoring residents were reenacted. This indicated either that many residents were not aware the bag limit had been liberalized to 1 bear/year or that bear numbers were reduced in accessible areas where residents commonly hunt.

Harvest Chronology. During the report period, 62–76% of the harvested grizzly bears were taken during September. The 5-year average for September was 74% (Table 3). Historically, most of the harvest was taken during September when most resident moose and caribou hunters and guided hunters are afield.

Transport Methods. During the report period, most successful grizzly bear hunters used horses (Table 4), which is similar to historical patterns. Hunters using 3- or 4-wheelers as their primary transportation during the past 9 regulatory years have harvested only 8 bears. Few trails exist in Unit 12 that give bear hunters using this type of transportation an advantage. An increase in the use of horses by successful hunters during the past 6 years also indicates increasing guide activity in Unit 12, as horses are used by most of the guides but by only a few residents.

Other Mortality

Intraspecific mortality inflicted by adult male bears is probably the greatest source of nonhunting bear mortality in Unit 12. Incidence of grizzly bears taken in defense of life or property (DLP) incidents was minimal.

HABITAT

Assessment

Unit 12 is good grizzly bear habitat with the exception of 2500 mi^2 of unvegetated mountaintops and ice fields. Bear habitat remained relatively undisturbed, except near a few small

communities, the Alaska Highway, and the Tok Cutoff. Like most other areas in Interior Alaska, streams in Unit 12 do not contain reliable seasonal salmon runs that are accessible to bears.

Variation in annual berry crops is often hypothesized as affecting harvest, bear/human encounters, den entrance dates, and productivity, but there are little quantitative or qualitative data to substantiate relationships. Beginning in 1999 we will annually assess the abundance of blueberries and cranberries along the road systems in Units 12 and 20E. We will create permanent sample areas, with plots selected by elevation.

Enhancement

Maintenance of a near-natural fire regime through provisions of the *Alaska Interagency Fire Management Plan: Fortymile Area* was the primary action taken in the unit to restore habitat diversity and productivity for all species. In areas that are under full fire suppression, other habitat enhancement methods are being considered. A cooperative ADF&G/DNR logging project is being planned for the Tok River valley. If implemented, clear cuts of 20–80 acres will be treated to enhance regeneration of deciduous shrubs to mimic natural succession. Bears and their prey species are expected to benefit.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

The initial objective for liberalizing grizzly bear harvest regulations in Unit 12 was to cause a temporary reduction in the bear population to benefit moose calf survival. However, moose calf survival increased beginning in the mid-1980s in the areas of the greatest bear harvest. We also found that calf survival increased in areas that received little bear harvest in adjacent Unit 20E. After monitoring this management technique for 15 years in Unit 20E and 13 years in Unit 12, I believe that reducing the grizzly bear populations by harvest in portions of these units is not effective in causing an increase in moose calf survival.

Reducing predator populations through conventional hunting and trapping is currently a socially accepted method of predator control. The public believes the methods work and commonly ask for more bear reduction programs to be initiated. In order to maintain credibility with the public and the scientific community, we need to determine if and when this method is effective in increasing ungulate populations and present these findings to the public.

During this period of liberal grizzly bear regulations in Units 12 and 20E, we learned that we can offer increased hunter opportunity and, with a few additional safeguards, still ensure adequate protection to the bear population. In Unit 12, based on the current estimated population size, 28 bears, including a maximum of 6 adult females, can be harvested annually without resulting in a bear population decline, assuming that harvest is evenly distributed in the unit. During the past 16 years, the annual female quota has been exceeded only once, and the overall quota only twice. However, harvest is not evenly distributed and has caused population declines and probably changes to the sex and age composition (Gardner, unpublished data). Based on Unit 12's harvest history, we can continue to offer liberal seasons and bag limits but need to develop techniques that will result in more even distribution of harvest. Harvest strategies should be developed by regional research biologists that allow for maximum hunter opportunity and adequate protection

to the grizzly bear population, while being user friendly to the hunter and the area management biologist.

CONCLUSIONS AND RECOMMENDATIONS

Grizzly bears continue to be well distributed throughout Unit 12. The 1998 population estimate was 350–425 bears (6.9–8.4 bears of all ages/1000 mi^2; 18.0–21.9 bears of all ages/1000 km^2) and population trend was probably stable. Harvest regulations were liberal and allowed for maximum hunting opportunity. During the 1980s due to uneven harvest distribution, bear numbers declined and population sex and age composition changed in the northern Wrangell and Mentasta Mountains, in the Tok River drainages, and near the permanent Unit 12 communities. Harvests have declined since 1988 and no longer cause bear population declines, but the population composition probably is still dominated by young males.

The objective to limit harvests so the 3-year mean harvest does not exceed 24 bears and has at least 55% males in the harvest was met. Based on my population estimate using harvest data and results from bear surveys conducted in similar habitat, I recommend the harvest objective be changed to: manage harvests so the 3-year mean harvest does not exceed 28 bears and has at least 55% males in the harvest.

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PREPARED BY:

Craig L Gardner
Wildlife Biologist III

SUBMITTED BY:

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Harry V Reynolds, III
Wildlife Biologist III

Table 1 Unit 12 grizzly bear harvest, regulatory years 1989–1990 through 1998–1999

Regulatory year	Reported							Estimated kill		Total estimated kill					
	Hunter kill				Nonhunting kill[a]										
	M	F	Unk	Total	M	F	Unk	Unreported	Illegal	M	(%)	F	(%)	Unk	Total
1989–1990															
Fall 1989	5	6	0	11	0	0	0	0	0	5	(45)	6	(55)	0	11
Spring 1990	2	0	0	2	0	0	0	0	0	2	(100)	0	(0)	0	2
Total	7	6	0	13	0	0	0	0	0	7	(54)	6	(46)	0	13
1990–1991															
Fall 1990	7	4	0	11	0	0	0	0	0	7	(64)	4	(36)	0	11
Spring 1991	2	3	0	5	0	0	0	0	0	2	(40)	3	(60)	0	5
Total	9	7	0	16	0	0	0	0	0	9	(56)	7	(44)	0	16
1991–1992															
Fall 1991	3	4	0	7	1	0	0	0	0	4	(50)	4	(50)	0	8
Spring 1992	2	0	0	2	1	0	0	0	0	3	(100)	0	(0)	0	3
Total	5	4	0	9	2	0	0	0	0	7	(64)	4	(36)	0	11
1992–1993															
Fall 1992	11	7	0	18	0	0	0	0	0	11	(61)	7	(39)	0	18
Spring 1993	4	2	0	6	0	0	0	0	0	4	(67)	2	(33)	0	6
Total	15	9	0	24	0	0	0	0	0	15	(63)	9	(37)	0	24
1993–1994															
Fall 1993	8	7	0	15	1	0	0	0	0	9	(56)	7	(44)	0	16
Spring 1994	2	0	0	2	0	0	0	0	0	2	(100)	0	(0)	0	2
Total	10	7	0	17	1	0	0	0	0	11	(61)	7	(39)	0	18
1994–1995															
Fall 1994	5	6	0	11	1	0	0	0	0	6	(50)	6	(50)	0	12
Spring 1995	2	1	0	3	1	0	0	0	0	3	(75)	1	(25)	0	4
Total	7	7	0	14	2	0	0	0	0	9	(56)	7	(44)	0	16
1995–1996															
Fall 1995	4	2	0	6	0	0	0	0	0	4	(67)	2	(33)	0	6
Spring 1996	2	0	0	2	0	0	0	0	0	2	(100)	0	(0)	0	2
Total	6	2	0	8	0	0	0	0	0	6	(75)	2	(25)	0	8
1996–1997															
Fall 1996	9	8	0	17	0	0	0	0	0	9	(53)	8	(47)	0	17
Spring 1997	3	1	0	4	0	0	0	0	0	3	(75)	1	(25)	0	4

Table 1 Continued

Regulatory year	Reported							Estimated kill		Total estimated kill					
	Hunter kill				Nonhunting kill[a]										
	M	F	Unk	Total	M	F	Unk	Unreported	Illegal	M	(%)	F	(%)	Unk	Total
Total	12	9	0	21	0	0	0	0	0	12	(57)	9	(43)	0	21
1997–1998															
Fall 1997	7	1	0	8	1	0	0	0	0	8	(89)	1	(11)	0	9
Spring 1998	3	0	0	3	0	1	0	0	0	3	(75)	1	(25)	0	4
Total	10	1	0	11	1	1	0	0	0	11	(85)	2	(15)	0	13
1998–1999[b]															
Fall 1998	5	4	0	9	1	0	0	0	0	6	(60)	4	(40)	0	10

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

[b] Preliminary harvest.

Table 2 Unit 12 grizzly bear successful hunter residency, regulatory years 1989–1990 through 1998–1999

Regulatory year	Unit resident	(%)	Other residents	(%)	Nonresident	(%)	Total successful hunters
1989–1990	6	(46)	3	(23)	4	(31)	13
1990–1991	2	(12)	7	(44)	7	(44)	16
1991–1992	0	(0)	3	(33)	6	(67)	9
1992–1993	7	(29)	6	(25)	11	(46)	24
1993–1994	1	(6)	6	(38)	9	(56)	16
1994–1995	2	(14)	1	(7)	11	(89)	14
1995–1996	0	(0)	1	(13)	7	(87)	8
1996–1997	5	(24)	4	(19)	12	(57)	21
1997–1998	4	(31)	1	(7)	8	(62)	13
1998–1999[a]	1	(10)	3	(30)	6	(60)	10

[a] Preliminary harvest.

Table 3 Unit 12 grizzly bear harvest chronology by month, regulatory years 1989–1990 through 1998–1999

Regulatory year	Harvest periods												
	Sep	(%)	Oct	(%)	Nov	(%)	Apr	(%)	May	(%)	Jun	(%)	*n*
1989–1990	10	(77)	0	(0)	0	(0)	0	(0)	2	(15)	0	(0)	13[a]
1990–1991	11	(69)	0	(0)	0	(0)	1	(6)	4	(25)	0	(0)	16
1991–1992	7	(64)	0	(0)	0	(0)	1	(9)	1	(9)	0	(0)	11[b]
1992–1993	14	(58)	2	(8)	2	(8)	0	(0)	6	(25)	0	(0)	24
1993–1994	14	(82)	1	(6)	0	(0)	1	(6)	1	(6)	0	(0)	17[a]
1994–1995	11	(73)	0	(0)	0	(0)	1	(7)	3	(20)	0	(0)	14[a]
1995–1996	6	(75)	0	(0)	0	(0)	0	(0)	2	(25)	0	(0)	8
1996–1997	16	(76)	0	(0)	0	(0)	0	(0)	4	(19)	0	(0)	21[a]
1997–1998	8	(62)	0	(0)	0	(0)	0	(0)	3	(23)	1	(8)	13[a]
1998–1999[c]	9	(90)	0	(0)	0	(0)							10[a]

[a] Includes 1 DLP bear.
[b] Includes 2 DLP bears.
[c] Preliminary harvest.

Table 4 Unit 12 grizzly bear harvest by transport method, regulatory years 1989–1990 through 1998–1999

Regulatory year	Harvest									
	Airplane (%)	Horse (%)	Boat (%)	3- or 4-wheeler (%)	Snowmachine (%)	ORV (%)	Highway vehicle (%)	Walking (%)	Unk (%)	*n*
1989–1990	4 (31)	2 (15)	1 (8)	0 (0)	1 (8)	4 (31)	0 (0)	0 (0)	1 (8)	13[a]
1990–1991	6 (38)	4 (25)	0 (0)	0 (0)	0 (0)	2 (13)	2 (13)	1 (6)	1 (6)	16
1991–1992	6 (67)	2 (22)	0 (0)	0 (0)	1 (11)	0 (0)	0 (0)	0 (0)	0 (0)	9
1992–1993	7 (29)	10 (42)	0 (0)	1 (4)	2 (8)	0 (0)	2 (8)	0 (0)	2 (8)	24
1993–1994	2 (12)	7 (41)	0 (0)	2 (12)	0 (0)	0 (0)	2 (12)	3 (18)	1 (6)	17[a]
1994–1995	4 (29)	7 (50)	0 (0)	1 (7)	0 (0)	0 (0)	2 (14)	0 (0)	0 (0)	14[a]
1995–1996	1 (13)	7 (86)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	8
1996–1997	4 (19)	10 (48)	1 (5)	4 (19)	0 (0)	1 (5)	1 (5)	0 (0)	0 (0)	21
1997–1998	2 (15)	8 (62)	1 (8)	0 (0)	0 (0)	0 (0)	0 (0)	2 (15)	0 (0)	13[b]
1998–1999[c]	1 (10)	4 (40)	0 (0)	0 (0)	0 (0)	2 (20)	2 (20)	0 (0)	1 (10)	10[a]

[a] Includes 1 DLP bear.
[b] Includes 2 DLP bear.
[c] Preliminary harvest.

LOCATION

GAME MANAGEMENT UNIT: 13 (22,857 mi^2)

GEOGRAPHIC DESCRIPTION: Nelchina Basin

BACKGROUND

The brown bear harvest in Unit 13 increased substantially during the early and mid-1980s. The average annual harvests for the periods between 1961 and 1969, 1970 and 1979, and 1980 and 1987 were 39, 58, and 109 brown bears, respectively. Interest in brown bear hunting by recreational hunters was high between 1980 and 1987, when seasons and bag limits were liberalized. Between 1987 and 1994 brown bear harvests declined from levels reported during the mid-1980s because the bag limit was reduced. Bear regulations were liberalized again by increasing the season and bag limit in 1995 and harvests have increased.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

To maintain a minimum unit population of 350 brown bears.

METHODS

Department representatives sealed skulls and hides of harvested bears. Skulls were measured, sex was determined, and a premolar tooth was extracted for aging. Sealers collected information on date and location of harvest and time spent afield by successful hunters. A hunter survey was sent to successful bear hunters for their opinion on regulation changes and their effects on hunting effort.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Brown bear density estimates are available for 2 different study areas in Unit 13E and 1 in Unit 13A. A 1979 estimate of 10.5 independent bears/1000 km^2 on the upper Susitna River (13E) was slightly higher than the 1987 figure of 6.36 independent bears/1000 km^2 (Ballard et al. 1982, Miller 1988, 1995). Miller (1995) concluded that because of overlapping confidence intervals and differences in survey methods, it could not be statistically demonstrated that a decline in bear numbers occurred even though the 1987 point estimate was much lower. Density estimates for the Su-Hydro Study Area (13E) in 1985 and 1995 are 18.75 and 23.31 independent bears/1000 km^2, respectively (Miller 1995). These results indicate increasing brown bear numbers in portions of 13E. A 1998 density estimate from the 13A West Nelchina Study Area was 21.3 independent bears/1000 km^2 (Testa, ADF&G memorandum July 1998). Comparison of the estimates between 13E and 13A indicates no difference in population size, and these values are among the highest estimates for brown bears in Interior and northern Alaska (Miller et al. 1997).

Population Size

Four separate population estimates were calculated for Unit 13 in the past 20 years. During the late 1970s an estimate of 1500 brown bears was calculated based solely on field observations, hunter reports, and harvests. Extrapolations from density estimates in the Upper Susitna River and Su-Hydro areas in 1979, 1985, and 1987 (Ballard et al. 1982, Miller 1987, 1988) resulted in a preliminary population estimate of 1228 brown bears, of which 823 were $\geq$ 2.0 years of age (Miller 1990*b*). Based on a model of sustainable harvest rates, 640–1120 bears were estimated to inhabit Unit 13 in 1993 (Miller 1993). Finally, a second destiny estimate for the 1985 Su-Hydro Study Area completed in 1995 resulted in an updated Unit 13 population estimate of 1450 brown bears in 1996 (Miller personal communication).

Population Composition

Miller (1993) reported that during 1980–1988, brown bear litters averaged 2.1 cubs of the year, 1.9 yearlings, and 1.8 two-year-olds. The estimated reproductive interval was 4.1 years, and the observed age at first reproduction was 5.6 years (range = 4–9). Litter size in 1998 on the Nelchina Study Area was 2.3 cubs of the year and 1.8 yearlings (Testa, 1998). Based on these reproductive parameters, the brown bear population in Unit 13 has a typical reproductive potential for an Interior population.

Miller (1995) presented the sex ratios of brown bears in the Su-Hydro Study Area during 2 different censuses 10 years apart. He estimated 82.4 males/100 females present in 1985, compared to 27.8 males/100 females in 1995. He did not find a change between censuses in the mean age of brown bears in the study area. Testa (1998) reported 48 males/100 females observed during the 1998 Nelchina Study Area census.

MORTALITY

Harvest

The 1993–94 and 1994–95 hunting seasons were 1 September to 31 May in all of Unit 13, except that portion of 13E west of the Alaska Railroad where the season opened on 10 September. The bag limit between 1990 and 1995 was 1 bear every 4 regulatory years. Starting in 1995–96, the season was 10 August–31 March in Unit 13, except 13E west of the Alaska Railroad, which remained unchanged, opening on 10 September. In 1995 the bag limit was liberalized to 1 bear every regulatory year.

Board of Game Actions and Emergency Orders. The Alaska State Legislature mandated intensive management of moose and caribou for human use in portions of Alaska under SB-77, passed in 1995. During the spring 1995 meeting, the board subsequently designated Unit 13 as an intensive management area. Board of Game findings (during intensive management discussions) were that brown bears were important predators of moose calves, that brown bears were abundant in Unit 13, and that brown bear numbers should be reduced to increase moose calf survival. The board took action to reduce bear numbers by increasing the sport harvest of brown bears by lengthening the fall 1995 season by 20 days, opening on 10 August instead of 1 September in Unit 13, except 13E west of the Alaska Railroad.

During its January 1995 meeting the Board of Game eliminated the $25 resident tag fee requirement for brown bears in Unit 13 effective 1 July 1995. Since 1995, the board has reviewed the tag fee requirement yearly, according to legislative mandate, and has dropped the fee requirement every year. The intent of the board is to increase the brown bear harvest in Unit 13. The rationale behind these liberalized seasons, bag limits, and tag fee elimination is that they encourage the incidental or opportunistic taking of brown bears by moose and caribou hunters.

Hunter Harvest. The reported 1997–98 sport harvest of brown bears was 134 (Table 1). The average annual take was 125 bears/year (range = 97–140) for the last 4 years since the Board of Game started liberalizing bear seasons. Interestingly, the average yearly harvest was also 125 bears a year (range = 97–138) during the 5-year period, between 1982–87, when harvests were historically the highest because of the 1 bear/year bag limit. The average annual harvest during the 5-year period from 1988–92, following a reduction in the bag limit and a somewhat reduced hunting season, was 82 bears a year (range = 73–98). The lowest harvest reported in recent years was 66 bears taken in 1993–94.

The 1995–96 brown bear harvest by subunits included 13A - 22 bears, 13B -18, 13C -19, 13D - 23, and 13E - 51. In all subunits the reported harvests were well above harvest levels reported since brown bear regulations were restricted in 1988. In 13E the reported take of 51 bears every year for the last 3 years is the highest harvest ever reported, exceeding the average annual harvest of 48 bears a year reported during the 3 peak harvest years 1984–86.

The 1997–98 brown bear harvest was 78 (58%) males and 56 (42%) females (Table 1). Males predominated in the harvest in all subunits except 13E, where males composed only 43% of the take for both sexes. Subunit 13E has had the most skewed harvest sex ratio as females have exceeded males (range = 53–65%) in the harvest since regulations were liberalized in 1995. The mean skull size was 20.7 inches for males and 19.8 inches for females. The mean age was 4.8 years for males and 5.7 years for females. The mean age and skull size for both males and females since harvests have increased show that a higher number of younger, smaller bears are being taken. In most years, the mean age of males taken in the fall was lower than for males taken in the spring. There is a less definite trend in ages of females, but females taken during the fall tend to be older, larger bears than females taken in spring.

Interpretation of size and age data in the harvest is difficult (Miller 1993) and can lead to false conclusions. With this in mind, the guarded conclusion reached after looking at Unit 13 data is that a high proportion of the yearly take includes young males, indicating recruitment and/or emigration into the population. There are, however, some old bears taken every year, which means that heavy bear harvests in previous years have not completely cropped the bear population. Older males are more often taken during spring because hunters can select for older bears by hunting early in April as older males are the first to emerge from dens. Young males are incidental fall kills by hunters taking any bear they can while hunting other big game species. We speculate that older females are taken in the fall because their cubs that accompanied them during spring may become lost during summer, making females legal during fall.

Hunter Residency and Success. Nonresident hunters took 33 (25%) bears in 1997–98 (Table 2). The number of bears taken by nonresidents has changed little in over 20 years, although the

percent of the harvest has declined as the total unit harvest increased. Local residents took 12 (9%) bears. The harvest by locals fluctuates appreciably between years with no trend evident. The highest harvest by local residents in any year was 19 bears in 1992–93. The nonlocal Alaska resident harvest increased appreciably in 1995–96, when hunting regulations were liberalized. Nonlocal Alaska resident bear harvests over the last 3 years have averaged 89 bears and are the highest reported since the mid 1980s, when liberal seasons and bag limits were also in effect. Bear tags were purchased by only 7–13% of successful resident hunters since eliminating the tag fee in 1995. Successful hunters averaged 4.3 days in the field to take a bear in 1996–97. In Unit 13 hunters have averaged 4.2 days hunting to take a bear during the last 15 years, indicating only a slight increase in hunting effort recently.

Harvest Chronology. For the 1997–98 regulatory year, hunters harvested 110 bears (82%) during the fall and 24 in the spring (Table 3). Throughout the current reporting period, the fall season has been the most important for bear harvests. The portion of the fall harvest that occurred during the 10–30 August season extension was 44% in 1995, 46% in 1996, and 30% in 1997. Spring harvests have fluctuated between years (Table 1). The reason for this fluctuation is unknown but may be related to snow conditions. Because hunters rely on snowmachines during spring, a drop in the April harvest (Table 3) may reflect poor spring snow conditions, limiting access. Also, a particularly late break-up would interfere with ORV access later in May.

Males composed 56% (n = 62) of the fall harvest in 1997. This is the first time in the 3 years since harvest regulations were liberalized that males have predominated in the fall kill (Table 1). It appears that as harvests increase, the percent males taken in the fall has declined. During the period from 1983–87 when bear harvests were high because of the 1 bear/year bag limit, males averaged only 45% of the fall take. Males have averaged 53% of the fall take for the last 20 years. Historically, more females have been taken during the early portion of the fall season, and it was thought that increasing the season length from 1 September to 10 August would provide for an additional increase in the harvest of females. Chronology data for the fall of 1996 and 1997 show that males composed 58% and 54% of the harvest, respectively, during the 10–30 August extension. It appears that hunters participating in the 10–30 August season extension were not selective for females and that the extension simply provides additional hunting opportunity.

The percent males in the spring 1998 harvest was 67% (n = 16). The percent males during the 1995–96 and 1996–97 seasons were 52% and 49%, respectively, and are the lowest reported. Since 1980 when spring seasons started, males have averaged 67% of the harvest. During spring seasons, the percent females taken increased as the season progressed, and often during the last week of the season, more females than males were taken (Miller 1990*a*). During the 1995–96 and 1996–97 seasons, the harvest in May was higher than in April and presumably resulted in higher female harvests. However, in 1997–98 the May harvest was also high but males predominated.

Transport Methods. Four-wheelers were the most important method of transportation for brown bear hunters in Unit 13; successful hunters also used aircraft and highway vehicles during this reporting period (Table 4). The importance of 4-wheelers as a transportation method has increased the last 3 years, and caribou and moose hunters prefer them during the early fall seasons. Unit 13 provides many areas with extensive trail systems that are ideally suited to 4-

wheeler transportation during the fall season. The extension of the fall bear season provided the opportunity for increased bear harvests incidentally while hunting moose and caribou. Since the most important transportation method for both these species are 4-wheelers, it is little wonder hunters prefer 4-wheelers instead of aircraft for hunting brown bear. Historically, aircraft have been the most important method of transportation for Unit 13 brown bear hunters, but their use has declined because of expense and a loss of remoteness in Unit 13 due to increased ORV penetration into previously untraveled parts of the unit. Snowmachine use increased in importance about 1989 when design changes made snowmachines more powerful and reliable, giving hunters the potential to travel into areas formerly considered too rough or remote. Transportation data showing use of snowmachines fluctuate between years, depending on snow conditions. Deep snow pack in April allows increased access by snowmachines and higher April harvests.

Hunter Attitudes. A hunter questionnaire was sent to 235 successful bear hunters who took a bear in Unit 13 between 1995–97. Hunter response was 54% (n = 128). Brown bears were the primary species hunted by 33% of those responding (n = 40 out of 120), while the incidental take was 67%. Incidental harvests are those in which hunters seek different species but also take a bear. Hunters seeking moose and caribou reported taking 85% of the incidental take.

The 10 August opening was important to bear hunters; 60% reported this extension allowed them added hunting opportunity. The most important regulation change reported by successful hunters in influencing their decision to hunt or take a bear was reducing the bag limit to 1 bear per year. Forty-nine percent felt they would not have taken a bear without this liberalization, and it was the most important change. The impact of the bag limit change becomes apparent when 42% of the hunters reported they may hunt brown bears in another unit next year. This is quite high and shows that having the opportunity to hunt bears in another unit is important. The bag limit change was not as important for Unit 13-only hunters; 36% felt they would probably take another bear in Unit 13. This did, however, increase to 72% that said they would take another Unit 13 bear if it was significantly larger or a better trophy. The bag limit change was important here in that it allowed the additional hunting opportunity to select a better trophy.

Other Mortality

There were 20 brown bears reported killed in defense of life or property (DLP) during this reporting period, an average of 4.0 bears/year and higher than the 2.8 bears/year average since 1961. No trend is evident in the DLP kill. The reported DLP harvest has always been considered a minimum estimate because some bears are shot and not reported, especially at remote cabins, home sites, and mining claims. The state requirement to salvage and surrender the hides of DLP bears often deters individuals from reporting DLP bears. Also, bears are not reported because individuals fear they may be cited if Fish and Wildlife Protection does not deem their DLP claim as valid.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

An important brown bear management problem is the divergent public attitude concerning brown bears. It appears one segment of the population likes to observe brown bears and favors management objectives that provide as large a number of bears in the population as biologically

possible. In contrast, some of the public, especially local residents, do not like living in proximity to bears. These individuals have usually experienced property damage, had livestock or pets killed by bears, or fear personal injury. Publications, including news articles, about bear problems or conflicts encourage and maintain the public's fear of bears. The frequent "scare" articles in the media are hard to overcome, and they perpetuate and promote the bear/human conflict problem. Fear of bears and other negative attitudes create a problem for management staff as public use and recreation increase in Unit 13. In dealing with bear/human conflicts at remote sites, I recommend the department maintain its policy of not killing or relocating problem bears. However, the policy is problematic near home sites and recreational areas, such as Kenny Lake or Lake Louise where there are numerous dwellings. An action plan or policy is needed for partially developed areas, especially along the road system, where there are frequent bear/human conflicts.

CONCLUSIONS AND RECOMMENDATIONS

A major problem pertaining to brown bear management is the difficulty in obtaining population data. Because of their low density and secretive behavior, spotting and counting bears is very difficult and expensive. This is especially true of interior grizzly populations that do not congregate on salmon streams and are wary of motorized vehicles. Because of this, population data are available for only limited portions of Unit 13. The unit bear estimate of 1450 bears was based on an extrapolation of known densities. Problems with this are obvious, as bear numbers may not be consistent throughout the unit, especially since we completed our density estimates in heavily hunted portions of the unit to determine if bear numbers had declined during high harvests.

Brown bear density estimates in 3 different portions of Unit 13 indicate that bear numbers are high in favorable habitat but may vary between areas. For example, comparison of the most recent census data from 13A and remote portions of 13E indicate similar bear densities, yet bear densities in the Upper Susitna region of 13E were lower than in the other 2 study areas. However, census results from the Upper Susitna are the least defendable because of sample size and survey techniques.

Population trend determination for Unit 13 brown bears is important because of the increased harvests and a management objective to reduce bear numbers. Census data from remote portions of 13E indicate that bear numbers were at least stable and may have actually increased, even with heavy hunting pressure and high harvests. In the Upper Susitna portion of 13E, a trend could not be determined because of overlapping confidence intervals. The only detectable effect of high human harvest was a decline in the sex ratio, with males less numerous than females. The mean age of the captured bears did not decline, however, indicating that hunters were not selecting for just older males but taking them as they occurred in the population. It does not appear that harvest rates in recent years are high enough to reduce the unit brown bear population.

Based on ADF&G predator-prey research results, the Board of Game identified brown bear predation of moose calves in Unit 13 as an important source of mortality. The board felt that if this predation on moose calves could be reduced, it might result in providing more moose for human use. A brown bear translocation in Unit 13, from which a very large portion of the brown

bears in the area were removed, resulted in an increase in calf survival, providing the basis for the idea that reducing brown bear numbers could increase moose calf survival. The approach adopted by the Board of Game was to attempt to reduce brown bear numbers in Unit 13 by increasing human harvests. This was not a new approach; during the early 1980s the board also liberalized seasons and bag limits to increase bear harvests. As a result of the liberal regulations, brown bear harvests between 1980 and 1987 were high and exceeded the calculated sustainable harvest rates for both conservative and liberal population estimates (Miller 1993). However, the assumption that increased bear harvests would result in a population decline was wrong because brown bear numbers were not reduced. Whether future sport harvests at the current level can reduce bear numbers enough to appreciably reduce brown bear predation on moose calves is unknown. The number of bears that need to be culled from the population to effect a population decline is also unknown. Current regulations that protect the reproductive portion of the population (sows with cubs and cubs) may protect enough sows to prevent ever reducing the population. An adult sow is only legal every third or fourth year.

High sport harvests of brown bears may not have the same impact on bear numbers as predicted using harvest models because the Unit 13 brown bear population is not closed, and the extent and effects of migration are unknown. Brown bears are fully or partially protected in both Denali and Wrangell St. Elias National Parks. These large parks are adjacent to Unit 13 and provide a source of migration. Also, plotting of kill locations in Unit 13 indicates that timbered portions of the unit serve as refugia because higher harvests are in more open habitats.

Hunting regulations became more liberal during this reporting period because intensive management legislation was mandated in 1995. A maximum sustainable harvest rate for brown bears in Unit 13 is estimated at 5.7% per year or 8% for bears $\geq$2.0 years (Miller 1988). This would result in an estimate of sustainable harvest of 85 bears per year. Harvests after liberalizing seasons and bag limits for intensive management exceed this estimate of sustainable harvest. Liberalizations attempted to increase the take of females, as historic harvest data indicate that sow harvests are higher during the earlier portion of fall season. The high female harvest in fall 1995 indicates that the season extension into August did successfully cull females. Under current seasons and bag limits, brown bears in Unit 13 are now subjected to some of the heaviest sport hunting pressure ever exerted on a bear population in Alaska. Although harvest modeling predicts the brown bear population cannot sustain such increased harvest pressure very long, earlier predictions, based on models of a population decline, did not come to fruition. It is very important that we adequately document effects of increasing sport harvests, and research should be focused on fully evaluating impacts of high sport harvests. Another research objective should be to evaluate changes, if any, in moose calf survival due to increased sport harvests of brown bears.

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Prepared by

Robert W. Tobey
Wildlife Biologist III

Submitted by

Michael G. McDonald
Wildlife Biologist III

Table 1 Unit 13 brown bear harvest, 1993–98

Regulatory	Hunter kill						Non-hunting kill[a]			Total estimated kill					
Year	M	(%)	F	(%)	Unk	Total	M	F	Unk.	M	(%)	F	(%)	Unk.	Total
1993–94															
Fall 93	19	(46)	22	(54)	1	42	--	--	--	19	(46)	22	(54)	1	42
Spring 94	19	(79)	5	(21)	0	24	--	--	--	19	(79)	5	(21)	0	24
Total	38	(58)	27	(42)	1	66	2	0	2	40	(60)	27	(40)	3	70
1994–95															
Fall 94	30	(52)	28	(48)	0	58	1	3	0	31	(50)	31	(50)	0	62
Spring 95	27	(69)	12	(31)	0	39	1	-	--	28	(70)	12	(30)	0	40
Total	57	(59)	40	(41)	0	97	2	3	0	59	(58)	43	(42)	0	102
1995–96															
Fall 95	40	(40)	60	(60)	0	100	0	1	0	40	(40)	61	(60)	0	101
Spring 96	14	(52)	13	(48)	0	27	0	1	0	14	(50)	14	(50)	0	28
Total	54	(43)	73	(57)	0	127	0	2	0	54	(42)	70	(58)	0	129
1996–97															
Fall 96	48	(49)	49	(51)	0	97	--	--	--	48	(49)	49	(51)	0	97
Spring 97	21	(49)	22	(51)	0	43	--	-	--	21	(49)	22	(51)	0	43
Total	69	(49)	71	(51)	0	140	5	0	0	74	(51)	71	(49)	0	145
1997–98															
Fall 97	62	(56)	48	(44)	0	110	--	--	--	62	(56)	48	(44)	0	110
Spring 98	16	(67)	8	(33)	0	24	--	--	--	16	(67)	8	(33)	0	24
Total	78	(58)	56	(42)	0	134	3	1	0	81	(59)	57	(41)	0	138

[a]Includes Defense of Life or Property kills, research mortalities, and other known human-caused accidental mortality.

Table 2 Unit 13 brown bear successful hunter residency, 1993–98

Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Successful hunters[b]
1993–94	5	(8)	35	(53)	26	(39)	66
1994–95	11	(11)	52	(54)	31	(32)	97
1995–96	4	(3)	87	(69)	34	(27)	127
1996–97	12	(9)	91	(65)	35	25	140
1997–98	12	(9)	89	(66)	33	25	134

[a] Local resident means resident of Unit 13.
[b] Includes unknown residency.

Table 3 Unit 13 brown bear harvest chronology percent by month, 1993–98

	Harvest periods												
Regulatory	August		September		October		November		April		May		*n*
year	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)	%	(*n*)	
1993–94			53	(35)	11	(7)	0	0	23	(15)	14	(9)	66
1994–95	1	(1)	53	(51)	6	(6)	0	0	24	(23)	16	(16)	97
1995–96	35	(43)	38	(50)	6	(7)	0	0	10	(13)	11	(14)	127
1996–97	29	(41)	38	(53)	1	(1)	1	1	14	(20)	17	(23)	140
1997–98	22	(30)	51	(68)	9	(12)	0	0	7	(9)	11	(15)	134

Table 4 Unit 13 brown bear harvest percent by transport method, 1993–98

Regulatory year	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Walk	Unk.	*n*
1993–94	32	11	3	18	14	6	11	6	0	66
1994–95	27	7	7	19	12	3	16	6	1	97
1995–96	21	11	5	35	6	4	13	3	2	127
1996–97	26	5	9	26	8	5	14	5	1	140
1997–98	22	7	7	27	4	8	18	6	0	134

LOCATION

GAME MANAGEMENT UNIT: 14 (6625 mi^2)

GEOGRAPHIC DESCRIPTION: Upper Cook Inlet

BACKGROUND

Brown bear density and distribution has been influenced by urbanization, agricultural settlement, and other human activities. Grauvogal (1990) estimated brown bear numbers during the late 1980s at 169–262. Harkness (1993) refined the Unit 14 brown bear population estimate to 185–239 bears. Griese (ADF&G files; Palmer, Alaska) estimated the population range at 125–232 during 1993.

Grauvogal (1990) first estimated the annual sustainable harvest for Unit 14 at 8–19 bears. Harkness (1993) calculated sustainable harvest at 8.2–12.6 bears. Griese (1995) applied a slightly more conservative annual allowable harvest (AAH) of 10 total bears and/or 3 independent females. In 1995 the harvest objective was established at 6–10 bears, including no more than 3 independent females. Since 1985, when only 7 bears were reported killed, the objective of 10 bears had been exceeded in all years except 1993 when 6 bears were reported killed. Griese (1998) suggested that the future population objective should reflect the permanent loss of bear habitat in Unit 14 and the human-use objective should reflect allowance of higher harvest to bring the bear population to within a societal carrying capacity.

Griese (1998) recommended a strong educational program, possibly using television and radio media, to inform visitors and residents how to act and live near bears. A high incidence of human-bear interactions occurs in Unit 14. Since 1985, 1–8 bears were killed annually unrelated to hunting. In 1995 two humans were fatally mauled by brown bears in Chugach State Park in Unit 14C.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

Since 1976 Unit 14A goals have been to provide the maximum opportunity to participate in hunting brown bears and, secondarily, to provide for optimum harvests of brown bears. In Unit 14B the goal has been to provide the maximum opportunity to participate in hunting brown bears. In Unit 14C the goals have been to provide an opportunity to view, photograph, and enjoy brown bears, and, secondarily, to provide an opportunity to hunt brown bears under aesthetically pleasing conditions.

MANAGEMENT OBJECTIVES

To maintain a brown bear population that is largely unaffected by human harvest.

Human-Use Objectives

Previous. To allow optimum opportunity to hunt brown bears with an annual allowable harvest (AAH) of 6–10 bears, including less than 3 females greater or equal to 3 years of age (independent females).

Current. To allow optimum opportunity to hunt brown bears with an annual allowable harvest (AAH) of 10–15 bears, including less than 5 females greater or equal to 3 years of age (independent females). See "Board of Game Actions and Emergency Orders" and "Conclusions and Recommendations" for explanation.

METHODS

Department personnel or authorized sealers interviewed hunters when they presented bears for sealing of skulls and hides. Skulls were measured, sex of bears determined, a premolar tooth was extracted for age determination, and information on date and location of kill and hunter effort were collected from successful hunters. Harvest data were compared to previous years.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The lack of field activities that would provide insight into population status and trend prevent a meaningful discussion. However, public reports and human-bear encounters indicated that bears were more common than 10–15 years ago, especially in Unit 14C.

MORTALITY

Harvest

Season and Bag Limit. In regulatory year 1997 the Subunit 14B hunting season for brown bears became 15 September through 25 May. In the remainder of Unit 14 and in Subunit 14B, previous to 1997, the season was 15 September through 10 October and 1–25 May. However, within Subunit 14C brown bear hunting was allowed only within "the remainder of 14C" which excluded Chugach State Park and the several special management areas. The bag limit for brown bears was 1 bear every 4 regulatory years. Harvesting cubs and sows accompanied by cubs was prohibited. Residents were required to possess the $25 tag for brown bear hunting.

Board of Game Actions and Emergency Orders. During the spring 1997 Board of Game meeting, the board liberalized the Unit 14B brown bear seasons keeping it open all winter. The season had previously been split with a 15 September–10 October season and the 1–25 May spring season. The season was liberalized at the request of a hunting guide from the unit.

During the spring 1999 Board of Game meeting, the hunting season in all open hunting areas of Unit 14 was made uniform with the Unit 14B season, 15 September through May 25. The department proposed this liberalization because of an apparent increase in the availability of brown bears. The increased availability was believed to be a function of reduced habitat and

increasing bear numbers. The department was hopeful that increased hunter opportunity would produce fewer bear human conflicts and fewer DLP kills in the future.

The board also agreed to department recommendations to increase human-use objectives for the Unit. The department recommended an annual hunter harvest objective of 10–15 bears unitwide with 5 or less being independent females.

Hunter Harvest. During the report period hunters reported a unit harvest of 21 bears (Table 1) for an average annual harvest of 11.5 bears. This 2-year average is greater than the average of 9.0 for the previous 5-year period (Griese 1998). The female bear component of the harvest during 1997–1998 was 26%, the lowest 2-year average observed in over 15 years.

The number of female bears >2 years of age taken by hunters during 1996–98 was 12 (4 bears each year).

During the report period hunters harvested 10 males and 5 females in Unit 14A, 10 males and 4 females in Unit 14B, and 1 male in Unit 14C. The male harvested in Unit 14C was the first harvested by hunters since 1986.

Hunter Residency. Nonresidents harvested 4 bears (19%) this period (Table 2); residents harvested the remaining 81% of the harvest.

Harvest Chronology. Although harvest chronology in Unit 14 has been variable, harvest during this period regularly peaked during late September (Table 3).

Transport Methods. Successful bear hunters preferred using highway vehicles and ORVs this report period (Table 4).

Other Mortality

Bears killed in defense of life or property during the report period totaled 13 bears (Table 1). Nine (7 males and 2 females) of those were killed in Unit 14A, 3 (2 males and 1 female) in Unit 14C, and 1 male in Unit 14B. No bears were recorded killed by trains or highway vehicles during the report period. Four bears (3 males and 1 of unknown sex) were killed illegally, 2 in Unit 14A and 2 in Unit 14B. We estimated an additional 15% unreported illegal harvest above that reported (Table 1).

CONCLUSIONS AND RECOMMENDATIONS

Management objectives appear to have been met, while human-use objectives were exceeded in years 1996, 1997, and 1998. AAH was exceeded in total numbers of reported bears killed (16, 17, and 13, respectively), and the AAH harvest of independent females was exceeded annually (by 4 bears each year during 1996–98).

Contrary to our own recommendations to take a conservative approach (Griese 1998), we recently recommended an increase in the AAH beginning in 1999. At the March 1999 Board of Game meeting, we recommended to the board that the brown bear human-use objective be

increased to current harvest levels, which appeared to be sustainable. By all indicators, such as frequency of bear sign observed by biologists, reports from the public, incidence of nuisance bears, and a steady harvest level, the brown bear subpopulation in the unit seems to be stable or increasing. We suggested a hunter harvest objective of 10–15 bears (AAH of 15) with a maximum of 5 independent females. Reported harvest (excluding estimated unreported kills) since 1987 (Griese 1991, Griese 1995) has almost annually exceeded our current AAH. The mean annual reported mortality during 1987–1998 was 14.2 bears. We reasoned that the maximum annual allowable harvest could be as high or higher than this 12-year average.

We also recommended the hunting season be uniform for all of Unit 14 except Chugach State Park, which remains closed to brown bear hunting. The effect would be an increased early spring hunting opportunity in Unit 14A and a small portion of 14C. This overwinter season format is currently standard for most adjacent units and apparently has not effected any substantial population decline. In those adjacent units, increases in harvest have centered on the adult male segment, which we speculate reduces male/female ratios.

We are meeting management goals for observation and photography of brown bears in the unit. The chances to see a brown bear in Chugach State Park, on a unit salmon stream, or on hillsides of the Chugach and Talkeetna Mountains are as high as they have ever been since statehood. Brown bears in and around Anchorage are seen almost daily during the summer months, creating a tremendous number of calls from concerned citizens.

We should continue to strive for a strong educational program to inform Alaskans and visitors how to act around bears and how to recognize undesirable interactions. Past approaches seemed inefficient at reaching and training most of the public. We are not fully using television and radio media that reach many Alaskans who do not read newspapers. However, our efforts during this report period to get information to recreationists were somewhat successful.

Many past conflicts with bears have been associated with fishing. Sportfishing regulations now have a brief explanation of defense-of-life-or-property regulations and suggestions on avoiding conflicts with bears when fishing.

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PREPARED BY:

Herman Griese
Wildlife Biologist III

SUBMITTED BY:

Michael McDonald
Assistant Management Coordinator

Table 1 Unit 14 brown bear harvest, 1993–97

Regulatory year	Reported: Hunter kill M	F	(%)	Unk.	Total	Reported: Nonhunting kill[a] M	F	Unk.	Estimated unreported kill	Total estimated kill M	(%)	F	(%)	Unk.	Total
1993															
Fall 93	1	1	(50)	0	2	1	0	0	1	2	(67)	1	(33)	1	4
Spring 94	2	1	(33)	0	3	0	0	0	0	2	(67)	1	(33)	0	3
Total	3	2	(40)	0	5	1	0	0	1	4	(67)	2	(33)	1	7
1994															
Fall 94	0	1	(100)	0	1	3	0	1	1	3	(75)	1	(25)	2	6
Spring 95	2	2	(50)	0	4	0	0	1	1	2	(50)	2	(50)	2	6
Total	2	3	(60)	0	5	3	0	2	2	5	(63)	3	(38)	4	12
1995															
Fall 95	4	5	(56)	0	9	2	0	0	1	6	(55)	5	(45)	1	12
Spring 96	1	1	(50)	0	2	0	1	0	1	1	(33)	2	(67)	1	4
Total	5	6	(55)	0	11	2	1	0	2	7	(50)	7	(50)	2	16
1996															
Fall 96	5	0	(0)	0	5	4	1	0	1	9	(90)	1	(10)	1	11
Spring 97	2	3	(60)	0	5	1	0	0	1	3	(50)	3	(50)	1	7
Total	7	3	(30)	0	10	5	1	0	2	12	(75)	4	(25)	2	18
1997															
Fall 97	2	1	(33)	0	3	0	0	0	1	2	(67)	1	(33)	1	4
Spring 98	7	2	(22)	0	9	3	1	1	1	10	(77)	3	(23)	2	15
Total	9	3	(25)	0	12	3	1	1	2	12	(75)	4	(25)	3	19
1998															
Fall 98	5	3	(38)	0	8	4	0	0		9	(75)	3	(25)	0	12
Spring 99	0	0	(-)	0	0	0	1	0		0	(0)	1	(100)	0	1
Total	5	3	(38)	0	8	4	1	0	2	9	(69)	4	(31)	2	15

[a]Includes DLP kills, illegal kills, other known human-caused accidental mortality, and nonfatal removal of orphaned cubs.

Table 2 Unit 14 brown bear successful hunter residency, 1993–97

Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total successful hunters
1993	5	(100)	0	(0)	0	(0)	5
1994	5	(100)	0	(0)	0	(0)	5
1995	10	(91)	1	(9)	0	(0)	11
1996	7	(78)	0	(0)	2	(22)	9
1997	9	(75)	1	(8)	2	(17)	12
1998	8	(100)	0	(0)	0	(0)	8

[a]Unit 14 residents

Table 3 Unit 14 brown bear harvest chronology percent by month, 1993–97

Regulatory year	Harvest periods								
	September		October		November-March	April	May		
	1–15	16–30	1–15	16–31		1–30	1–15	16–31	*n*
1993	0	40	0	0	--	--	40	20	5
1994	0	20	0	0	--	--	60	20	5
1995	18	45	18	0	--	--	18	0	11
1996	0	44	11	0	--	--	33	11	9
1997	19	50	8	0	0	8	0	17	12
1998	0	63	38	0	0	0	0	0	8

Table 4 Unit 14 brown bear harvest percent by transport method, 1993–97

Regulatory year	Percent of harvest						*n*
	Airplane	Horse	Boat	ORV	Highway vehicle	Other/ Unknown	
1993	0	0	0	40	20	40	5
1994	0	0	40	20	20	20	5
1995	9	0	27	0	36	27	11
1996	22	0	0	33	33	11	9
1997	17	0	0	33	33	17	12
1998	0	0	13	50	25	13	8

LOCATION

GAME MANAGEMENT UNIT: 16 (12,255 mi^2)

GEOGRAPHIC DESCRIPTION: West side of Cook Inlet

BACKGROUND

Although the actual size or density of the brown bear population in Unit 16 has never been measured, Griese (1993) estimated the population at 586–1156. Estimated brown bear densities ranged from no bears on Kalgin Island to an assumed unit-high in the coastal and foothill areas of Redoubt Bay and Trading Bay. Lacking survey data, biologists had tracked harvest data to estimate population trends but more recently have also relied on reports by long-time residents or visitors to refine estimates of trend (Griese 1998).

Hunter harvest peaked in 1985 following liberalization of bear hunting seasons in Unit 16. Between 1961 and 1983 harvest ranged from 17 to 46 bears annually. During 1984 seasons were extended to allow hunting during September through May. Harvest during 1984 reached 66 bears and then peaked at 89 bears the following year. From 1986 through 1992 harvest varied from 84 to 60 bears, exhibiting a general declining trend. From 1993 through 1995 harvest increased only slightly from 40 to 52 bears. Poor spring hunting weather and a low fall hunter population (Griese 1998) may have influenced this period of low harvest. Moose hunter participation declined in fall 1993 due to newly enacted antler restrictions (Griese 1995). Harvest has since increased reaching 64 bears during 1996 and 1998.

Griese (1993) estimated an annual sustainable harvest of 55 bears including no more than 18 females >2 years old. Harvest annually exceeded this estimate of a sustainable level during 1984–1992. Harvest of the >2-year old female segment exceeded estimated sustainable levels in all but 4 years (1988, 1989, 1993, and 1994). Harvest of >2-year-old females reached or exceeded 30 bears during 1985 (32), 1987 (31), and 1992 (30).

In spring 1994, the Board of Game provided direction to the department to allow the brown bear population in Unit 16 to decline. The board determined that moose was the priority species in Unit 16 and a high population of brown bears conflicted with moose population productivity. Griese (1995) modified the brown bear population objective to reflect that priority. Griese (1998) recommended further modification, producing current management goals and objectives that should result in a slight annual brown bear decline.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

To allow the number of breeding females in the population to decrease by providing optimal opportunity to hunt brown bears.

POPULATION OBJECTIVES

To reach desirable predator/prey ratios by allowing the brown bear population to decline slightly.

HUMAN-USE OBJECTIVES

To allow human use to reach a 3-year average harvest of 28 females >2 years old.

METHODS

Biologists monitored brown bear harvests by sealing skulls and hides of harvested brown bears. Department personnel or designated sealers measured skulls, determined sex of bears, extracted a premolar for age determination, and recorded date and location of kill, hunter effort, and transportation method.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The lack of field activities designed to measure trend or status of the brown bear population prevented a meaningful discussion on the topic. Harvest trends indicate a stable population, while comments from unit residents and others visiting the unit suggested a growing brown bear population.

Population Size

Griese (1993) had estimated the population to be within the range of 586–1156 bears. During calculations of harvest objectives, Griese (1998) used a conservative population estimate of 700 bears.

MORTALITY

Harvest

The most recent reported 3-year (1996–98) average annual brown bear harvest in Unit 16 was 58.7 bears. Included in this number were 20.0 females >2 years. The female harvest did not fully reach human-use objectives for this period. Estimates of unreported kills from wounding loss and poaching (Tables 1 and 2) added an additional 6 bears annually to the average; half would probably have been females.

Age and Skull Size of Hunter-Killed Bears. The most recent 3-year-average age of male bears was measured at 6.9 years (n = 108), and the average skull size was 21.9 inches (n =108). These measurements remain below the 1985–89 average when age of males was 7.8 years (n = 218) (Griese 1995). The average age of female bears for this report period was 5.0 years (n = 68), and average skull size was 18.8 inches (n = 68). Female statistics have declined since 1984.

Season and Bag Limit. The open brown bear hunting season was 1 September–25 May. The legal bag limit was 1 bear every 4 regulatory years, and the resident tag fee was required. Cubs and females accompanied by cubs were not legal to take. Beginning in 1998, within the Denali State Park portion of Unit 16A, the season was 1 September–31 May.

Board of Game Actions and Emergency Orders. During March 1999 the Board of Game amended and adopted a proposal that lengthened the Unit 16B fall hunting season (opens 10 August). The original proposal was to eliminate resident tag fees and was in reaction to complaints about high bear densities. The department recommended an increase in season length as an alternative to reach management objectives.

Hunter Harvest. With the exception of 1997, hunter harvest has increased from the low harvest during 1993. The low harvests during 1997 and, to some extent, 1998 were the products of poor weather and poor snow conditions during spring. The portion of the Unit 16 harvest taken during spring typically exceeded 40% of the harvest, but during 1997 and 1998 the spring harvest failed to reach 20% of the total harvest. The average harvest for the reporting period was 3.7 bears in Unit 16A (Table 1) and 51.7 bears in Unit 16B (Table 2).

Hunter Residency and Success. The composition of successful hunter residency during this report period changed little from previous years. Nonresident hunters accounted for 48–59% of bears killed, and nonlocal Alaska residents claimed 38–52% (Table 3) of the harvest. Unit resident hunters killed 0–3% of the bear harvest.

Harvest Chronology. The major portion of hunter bear harvest substantially shifted to September during 1997 and 1998 due to a considerable reduction in April harvest (Table 4). The shift to September was due to poor April and May hunting conditions. During 1998, September harvest was high with 44 brown bears taken.

Transport Methods. Successful brown bear hunters still preferred using airplanes for transportation (Table 5). During the report period 67–83% of successful hunters used aircraft. While fears that snowmachine technology would allow more hunters to successfully take bears in the unit (Griese 1998), poor snow conditions in recent springs have delayed any apparent influence on the total harvest.

Other Mortality

During the report period, reported nonhunting kills averaged 3.3 bears annually. The composition was 67% female bears.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Griese (1998) highlighted dangerous interactions between humans and bears caused by fishing activities on certain rivers and streams. The Big River Lakes sockeye salmon sport fishery exemplifies the issue that needed resolution. Fishermen attracted by the promise of easy limits and bear viewing opportunities concentrated in an extremely small section of the water system. Bears, likewise, concentrated for easy fishing and "panhandling" anglers.

The department responded during this report period by increasing special area permit requirements for commercial operators. Sport Fish Division inserted recommendations for dealing with bears in their fishing regulation booklet. At the recommendation of the commissioner, a multidivisional task force met to sculpt a user management strategy to promote safer conditions for fisherman and bear viewers, while giving bears more room to feed naturally

on salmon. The management strategy developed by this task force will probably be refined in coming years (J. Meehan, personal communication).

CONCLUSIONS AND RECOMMENDATIONS

The new management objectives did not appear to be met during this report period. Although measurement of the predator/prey ratio was not attempted, the human-use objective did not reach the allowed 3-year average of 28 females >2 years. The 1996–1998 average reached only 20 females >2 years. However, actions taken by the Board of Game during 1999 to substantially liberalize fall season in Unit 16B will probably allow future harvest of females to reach the desired objective.

As in previous management reports (Griese 1993, Griese 1995, Griese 1998), I recommend that unsuccessful hunters be required to report hunter effort. This is especially important in the absence of a reliable and affordable survey technique for brown bears. I encourage researchers to pursue a practicable survey method to measure bear population size and trends.

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PREPARED BY
Herman Griese
Wildlife Biologist III

SUBMITTED BY
Michael McDonald
Assistant Management Coordinator

Table 1 Unit 16A brown bear harvest, 1993–98

Regulatory year	Reported: Hunter kill M	F	(%)	Unk.	Total	Reported: Nonhunting kill[a] M	F	Unk.	Estimated unreported kill	Total estimated kill: M (%)	F (%)	Unk.	Total
1993													
Fall 93	0	0	(0)	0	0	0	0	0		0 (0)	0 (0)	0	0
Spring 94	2	0	(0)	0	2	0	0	0		2 (100)	0 (0)	0	2
Total	2	0	(0)	0	2	0	0	0	0	2 (100)	0 (0)	0	2
1994													
Fall 94	3	1	(25)	0	4	0	0	0		3 (75)	1 (25)	1	4
Spring 95	1	2	(67)	0	3	0	0	0		1 (33)	2 (67)	0	3
Total	4	3	(43)	0	7	0	0	0	1	4 (57)	3 (43)	1	8
1995													
Fall 95	1	1	(50)	0	2	0	1	0		1 (33)	2 (67)	0	3
Spring 96	2	2	(50)	0	4	0	0	0		3 (60)	2 (40)	0	5
Total	3	3	(50)	0	6	0	1	0	1	4 (50)	4 (50)	1	9
1996													
Fall 96	1	1	(50)	0	2	0	0	0		1 (50)	1 (50)	0	2
Spring 97	2	0	(0)	0	2	0	0	0		2 (100)	0 (0)	0	2
Total	3	1	(25)	0	4	0	0	0	1	3 (75)	1 (25)	1	5
1997													
Fall 97	2	2	(50)	0	4	0	1	0		2 (40)	3 (60)	0	5
Spring 98	1	0	(0)	0	1	1	0	0		2 (100)	0 (0)	0	2
Total	3	2	(40)	0	5	1	1	0	1	4 (57)	3 (43)	1	8

Table 1 Continued

Regulatory	Reported								Estimated unreported kill	Total estimated kill				
	Hunter kill					Nonhunting kill[a]								
year	M	F	(%)	Unk.	Total	M	F	Unk.		M	(%)	F	(%)	Unk.	Total
1998															
Fall 98	0	1	(100)	0	1	0	0	0		0	(0)	1	(100)	0	1
Spring 99	0	1	(100)	0	1	0	0	0		0	(0)	1	(100)	0	1
Total	0	2	(100)	0	2	0	0	0	1	0	(0)	2	(100)	1	3

[a]Includes DLP kills, illegal kills, other known human-caused accidental mortality, and non-fatal removal of orphaned cubs.

Table 2 Unit 16B brown bear harvest, 1993–98

Regulatory year	Reported: Hunter kill M	F	(%)	Unk.	Total	Reported: Nonhunting kill[a] M	F	Unk.	Estimated Unreported kill	Total estimated kill M	(%)	F	(%)	Unk.	Total
1993															
Fall 93	8	12	(60)	0	20	0	1	0		8	(38)	13	(62)	0	21
Spring 94	18	0	(0)	0	18	0	0	0		18	(100)	0	(0)	0	18
Total	26	12	(32)	0	38	0	1	0	2	26	(67)	13	(33)	2	41
1994															
Fall 94	15	8	(35)	0	23	0	0	0		15	(75)	8	(25)	0	23
Spring 95	19	1	(5)	0	20	0	0	0		19	(95)	1	(5)	0	20
Total	34	9	(21)	0	43	0	0	0	4	34	(79)	9	(21)	4	47
1995															
Fall 95	12	19	(61)	0	31	2	1	2		14	(41)	20	(59)	2	36
Spring 96	14	1	(7)	0	15	0	0	0		14	(93)	1	(7)	0	15
Total	26	20	(43)	0	46	2	1	2	5	28	(57)	21	(43)	7	56
1996															
Fall 96	13	16	(55)	0	29	2	0	0		15	(48)	16	(52)	0	31
Spring 97	28	3	(10)	0	31	1	0	1		29	(88)	4	(12)	1	33
Total	41	19	(32)	0	60	3	0	1	6	44	(70)	19	(30)	7	70
1997															
Fall 97	13	15	(54)	0	28	0	1	0		13	(45)	16	(55)	0	29
Spring 98	4	1	(20)	0	5	0	0	0		4	(80)	1	(20)	0	5
Total	17	16	(48)	0	33	0	1	0	3	17	(50)	17	(50)	3	37
1998															
Fall 98	29	21	(42)	0	50	0	3	0		29	(55)	24	(45)	0	53
Spring 99	10	2	(17)	0	12	0	0	0		10	(83)	2	(17)	0	12
Total	39	23	(35)	0	62	0	3	0	6	39	(60)	26	(40)	6	71

[a]Includes DLP kills, illegal kills, other known human-caused accidental mortality, and nonfatal removal of orphaned cubs.

Table 3 Unit 16 brown bear successful hunter residency, 1993–98

Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total[b] successful hunters
1993	2	(5)	8	(20)	30	(75)	40
1994	2	(4)	18	(37)	29	(59)	50
1995	2	(4)	24	(47)	25	(49)	52
1996	2	(3)	24	(38)	37	(59)	64
1997	1	(3)	17	(44)	21	(54)	39
1998	0	(0)	33	(52)	31	(48)	64

[a]Unit 16 residents

[b]Includes unknown residency

Table 4 Unit 16 brown bear harvest chronology percent by month, 1993–98

Regulatory year	Harvest periods September %	October %	November %	March %	April %	May %	*n*
1993	43	8	0	3	45	3	40
1994	50	4	0	4	32	10	50
1995	46	15	2	0	27	10	52
1996	42	6	0	6	39	6	64
1997	62	21	0	3	13	3	39
1998	69	9	2	2	16	3	64

Table 5 Unit 16 brown bear harvest percent by transport method, 1993–98

Regulatory year	Percent of harvest							
	Airplane %	Horse %	Boat %	Snowmachine %	ORV %	Highway vehicle %	Other/ Unknown %	*n*
1993	80	8	0	5	3	0	5	40
1994	66	12	2	8	4	8	0	50
1995	71	4	6	2	4	4	10	52
1996	73	6	9	3	2	6	0	64
1997	67	5	15	0	10	3	0	39
1998	83	3	8	2	3	0	2	64

LOCATION

GAME MANAGEMENT UNIT: 17 A, B, and C (18,800 mi^2)

GEOGRAPHIC DESCRIPTION: Northern Bristol Bay

BACKGROUND

Brown bears are common throughout the northern Bristol Bay area and are seasonally abundant along salmon spawning areas in the Nushagak, Mulchatna, Togiak, and the Kulukak River drainages as well as along the Wood River Lakes. Bears are also observed near aggregations of the Mulchatna caribou herd.

Bears in Unit 17 are neither as abundant nor as large as those found along the Alaska Peninsula; consequently, there has never been as much hunting pressure on this bear population. Annual reported harvests have rarely exceeded 50 bears per year. Prior to 1970, few bears were reported as harvested from the unit. When the Board of Game established alternate year seasons in Unit 9 in 1973, the number of bear hunters in Unit 17 increased. From 1972/73 to 1980/81, the harvest was generally balanced between the spring and fall seasons. Since then, there have been higher harvests during fall seasons than during the spring (Figure 1).

One reason for the increase in the fall harvest is increased hunting pressure on the Mulchatna caribou herd as it has nearly quintupled in number during the past decade (Van Daele, 1997). Reported moose harvests also increased dramatically during this same period. Because more hunters were afield pursuing caribou and moose, they killed more bears either incidentally or during "combination" hunts. The mean skull size of harvested males has not shown many dramatic changes from one year to the next, but the mean skull size of harvested males has generally been declining since 1990 (Figure 2). Harvest data show a declining trend in the proportion of males in the annual harvest from 1980/81 to 1987/88, with a return to historic levels since implementation of more restrictive seasons (Figure 3).

Reported harvests are only a part of the brown bears killed in the unit. All villages, including Dillingham, have open landfills that attract bears during the spring, summer, and fall. Residential garbage, dog food, and fish-drying racks also bring bears close to humans. Some local residents have a low tolerance for bears near villages and fish sites, and they occasionally kill bears in these areas. Although reporting rates seem to have improved in recent years, there are still nonhunting mortalities that are reported either indirectly or not at all. Because of the widespread occurrence of unreported kills, any conclusions based solely on harvest data must be viewed with caution.

POPULATION OBJECTIVE

Maintain a brown bear population that will sustain an annual harvest of 50 bears composed of at least 50% males.

METHODS

Each brown bear legally harvested or killed in defense of life or property (DLP) in the unit is sealed, the skull is measured, sex determined, and a premolar tooth extracted and aged. We record data on hunter residency, number of days hunted, transportation used, and date and location of kill at the time of sealing. When possible, we investigate circumstances surrounding DLP and illegal kills. We collect subjective population data during caribou and moose surveys. Reports from field workers are also used to estimate bear population trends.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The brown bear population is probably stable to increasing unitwide. This is likely the case in most of Units 17A, 17C, and the remote portions of Unit 17B. Bears living in portions of Unit 17B along the Nushagak and Mulchatna Rivers experience the greatest harvest pressure. This portion of the bear population was declining slightly, but appears to have stabilized.

Population Size

No population size or density estimates have been made for the brown bear population in Unit 17. Densities appear to be significantly lower than those observed along the Alaska Peninsula. Incidental observations suggest a population density comparable to that observed in the Susitna River study area (2.79 bears/100 km^2) (Miller et al. 1987). This would indicate a population estimate of roughly 1350 independent (>2 years old) bears in Unit 17.

Distribution and Movements

We know little about the distribution and movements of brown bears in this unit. Bears concentrate along salmon spawning streams throughout the summer and fall. Individual bears and family groups are commonly observed near postcalving aggregations of caribou in June and July. We have seen den sites in the mountains west of the Wood River Lake system and along the upper Nushagak River.

MORTALITY

Harvest

Season and Bag Limit

Units 17A & 17C	Apr 15–May 25 Sep 10–Oct. 10	1 bear per 4 regulatory years
Unit 17B	Apr 15–May 25 Sep 20–Oct. 10	1 bear per 4 regulatory years
Western Alaska Brown Bear Management Area (including Unit 17)	Sep 1–May 31	1 bear per regulatory year

Board of Game Actions and Emergency Orders. During their spring 1997 meetings, the Board of Game changed the opening date of the spring hunting season from May 10 to April 15. The board also included all of Unit 17 in the Western Alaska Brown Bear Management Area. No emergency orders were issued during this reporting period.

Human-Induced Mortality. During the 1996/97 hunting seasons, 47 hunters reported harvesting brown bears in Unit 17, including 31 males (66%), 15 females (32%), and 1 bear of unknown sex (2%) (Table 1). During the 1997/98 hunting seasons, 65 hunters reported harvesting brown bears in Unit 17, including 41 males (63%) and 24 females (37%) (Table 1). This reported harvest was higher than the mean annual reported harvest of the previous 5 years (42.2 bears). No bears were reported harvested in Unit 17 under the provisions of the Western Alaska Brown Bear Management Area.

The average skull size of bears harvested in 1996/97 was 22.9" (n = 31) for males and 20.2" (n = 12) for females. The average skull size of bears harvested in 1997/98 was 22.8" (n = 41) for males and 20.3" (n = 23) for females. In 1996/97, 3 bears (all males) were reported harvested in Unit 17A; 28 (18 males, 9 females, and 1 unknown sex) were reported harvested in Unit 17B; and 17 (11 males and 6 females) were reported from Unit 17C. In 1997/98, 3 bears (all males) were reported harvested in Unit 17A, 45 (27 males and 18 females) were reported harvested in Unit 17B, and 17 (11 males and 6 females) were reported from Unit 17C. In the past 5 years, 7% of the bears reported harvested in the unit have been taken in unit 17A, 65.7% in 17B, and 27.4 in 17C (Table 2).

Hunter Residency and Success. Nonresidents account for most of the reported brown bear harvest in Unit 17. During the 1996/97 seasons, nonresidents took 83% of the bears reported harvested in the unit. During the 1997/98 seasons, nonresidents took 84.6% of the bears reported harvested in the unit (Table 3).

Harvest Chronology. Thirty bears were reported harvested during the fall 1996 hunting season, and 17 bears were reported harvested during the spring 1997 season. Thirty-seven bears were reported harvested during the fall 1997 hunting season, and 28 bears were reported harvested during the spring 1998 season (Table 1). Late September has consistently been the time most bears are harvested in Unit 17 (Table 4).

Transport Methods. Most successful bear hunters in Unit 17 used aircraft for access. Boats were the only other consistently used method of access (Table 5).

Other Mortality

Five brown bears were killed in defense of life or property in Unit 17 during the 1996/97 regulatory year. A hunter who did not possess a big game tag illegally killed 1 additional bear. Nine brown bears were killed in defense of life or property in Unit 17 during the 1997/98 regulatory year. Four additional bears were killed illegally.

HABITAT

Assessment

Brown bear habitat in Unit 17 is virtually unaltered and in excellent condition. Salmon stocks are carefully managed, and escapements are adequate for the needs of the current bear population. Increasing ungulate populations in the unit also provide an abundant food supply for bears. Human settlements are relatively small and unobtrusive, and the increased localized food sources around these settlements (human food and garbage) enhances the areas as bear habitat. However, bears using areas frequented by humans run the risk of being shot.

NONREGULATORY PROBLEMS/NEEDS

A joint ADF&G/U.S. Fish and Wildlife Service (FWS) research project started in 1992 was continued during this reporting period. The objectives of this project are to estimate bear densities, collect baseline population data, and to delineate habitat-use patterns for brown bears in portions of the Togiak and Yukon Delta National Wildlife Refuges (northwestern Unit 17A and Unit 18). Bears radiocollared in 1993, 1994, and 1997 were tracked at least twice per month.

To reduce nuisance bear complaints and illegal kills, a public education effort was continued in the unit. Radio announcements, public meetings, and a weekly newspaper article have been used to teach rural residents about bear behavior and to disseminate advice on how to deal with bear problems. The department is working with local city and village government representatives and the Dillingham city police to enforce existing regulations when bear problems are caused by improper food or garbage storage.

The lack of objective data on the population parameters of the Unit 17 bear population and the paucity of information on nonhunting mortality make effective management difficult. The department should develop and pursue other cooperative bear research programs with the FWS and the National Park Service to determine the estimated bear density in at least a portion of Unit 17.

We should continue efforts to encourage local residents to report all bears killed and to educate them on bear behavior and ways to minimize problems with bears. We should also emphasize nonlethal methods of dealing with "nuisance" bears. Concurrent with these efforts, we should work with local village governments and the Department of Environmental Conservation to improve landfills so they are less of an attractant to bears.

The Dillingham dump was consistently used by at least 40 individual bears (including cubs) during this reporting period. Most bears visited the dump for less than 30 minutes per day, but about 10 were regular visitors that seemed to acquire most of their sustenance from the dump. We will continue to work with the City of Dillingham to explore ways to minimize bear/human conflicts. This will be especially important as the proposed 2000 closure date for the dump draws near.

RESULTS AND CONCLUSIONS

We are meeting our population objective of maintaining a brown bear population that will support a harvest of 50 bears per year, although this level of harvest has only been achieved during 4 regulatory years since the inception of mandatory sealing in 1962. Subjective evidence indicates the population is large enough to support such a harvest if the level of nonhunting mortality is reduced. The population objective of at least 50% males in the reported harvest has been met in most years, but the sex ratio for all bears killed in the unit is unknown.

One of the most significant problems with the bear population is the unequal distribution of harvest. The bear population along the Nushagak and Mulchatna Rivers should be monitored closely to watch for signs of overharvest. Efforts to better distribute hunting pressure to other areas of the unit are showing some signs of success and should be continued.

Changing the intolerant attitude of many local residents toward bears is a significant challenge. We have instituted a multifaceted approach including education, enforcement, and implementation of nonlethal methods to minimize antagonistic bear-human encounters. It is difficult to objectively measure the success of these efforts, but in recent years there probably has been improvement.

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PREPARED BY
James D. Woolington
Wildlife Biologist III

SUBMITTED BY
Michael G. McDonald
Assistant Management Coordinator

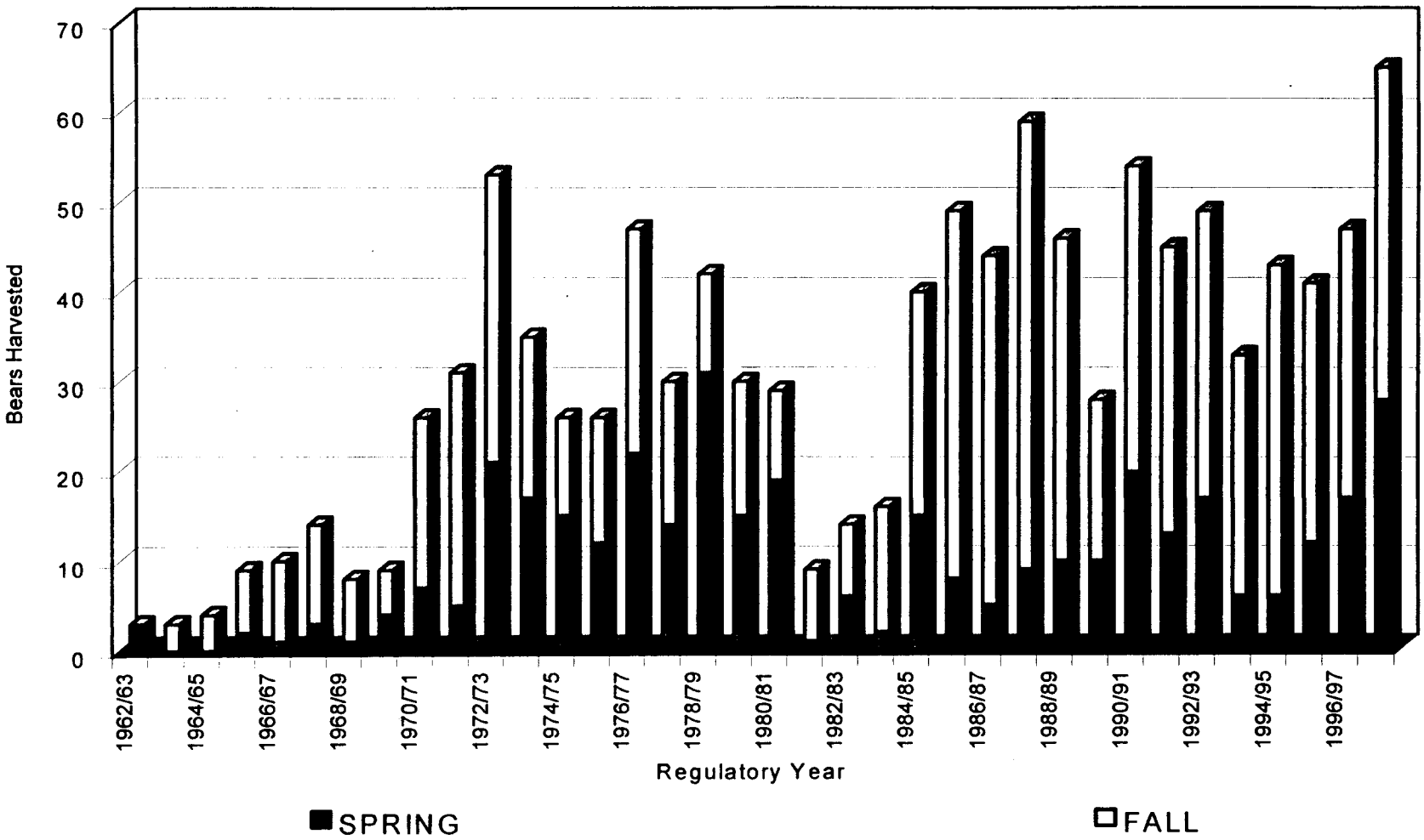

Figure 1 Unit 17 reported brown bear harvest, 1962/63–1997/98

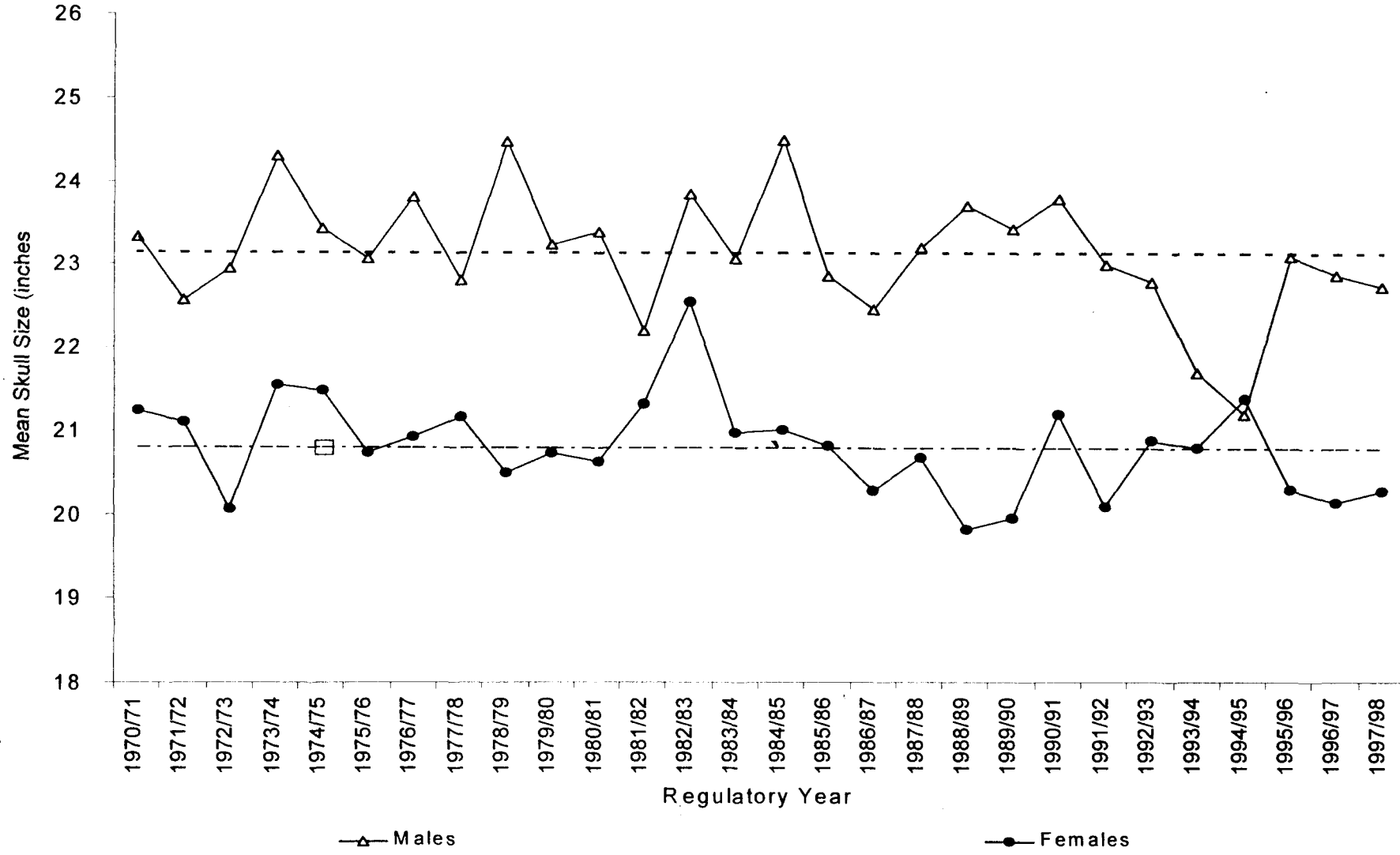

Figure 2 Unit 17 average skull sizes of brown bears, 1970/71–1997/98

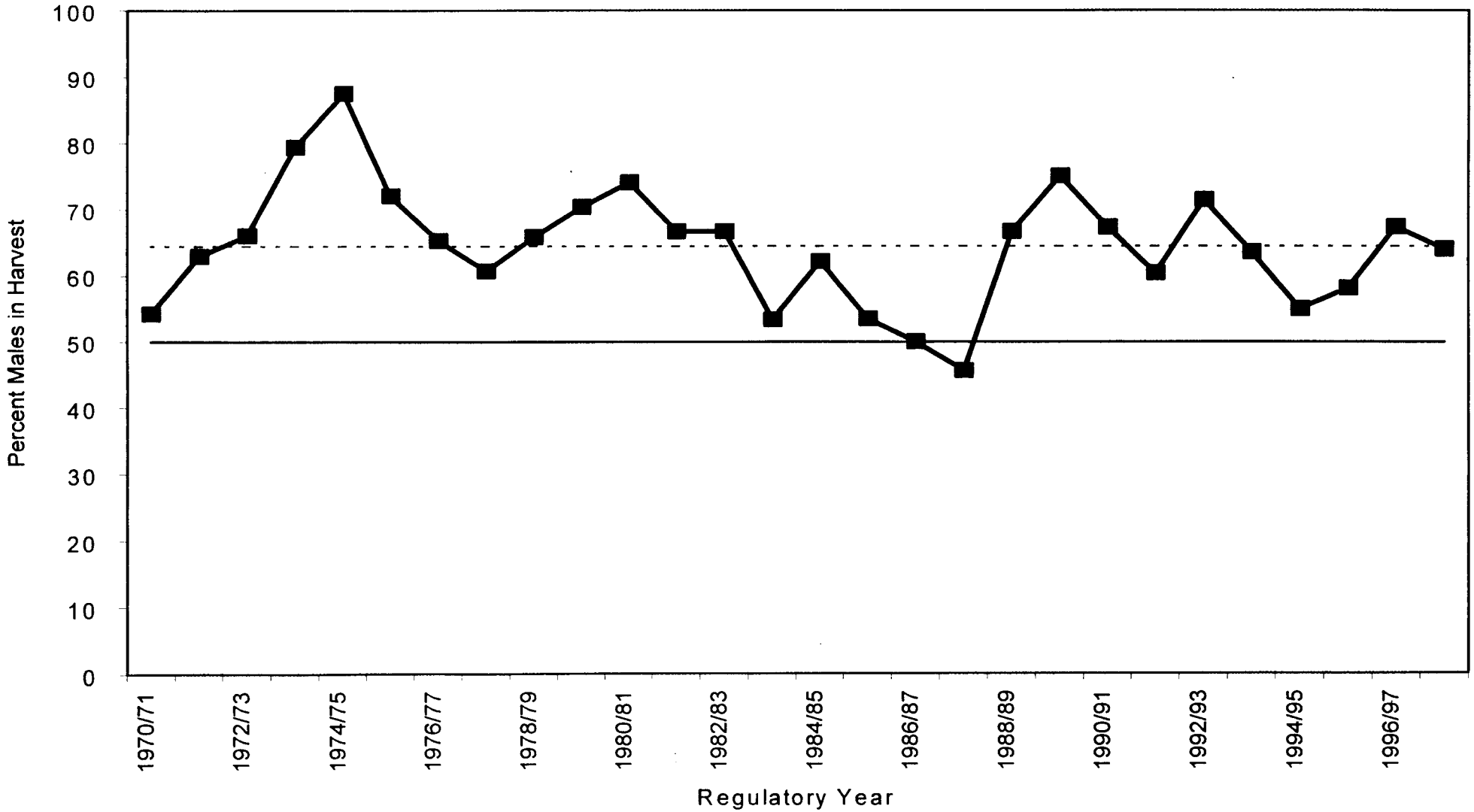

Figure 3 Percentage of male brown bears in the Unit 17 harvest, 1970/71–1997/98

Table 1 Unit 17 brown bear harvest, 1991/92–1997/98

Regulatory year	Hunter Kill				Nonhunting Kill				Total reported kill			
	Male	Female	Unk	Total	Male	Female	Unk	Total	Male	Female	Unk	Total
1991												
Fall '91	13	17	2	32	1	1	1	3	14	18	3	35
Spring '92	13	0	0	13	0	1	1	2	13	1	1	15
Total	26	17	2	45	1	2	2	5	27	19	4	50
1992												
Fall '92	24	8	0	32	2	1	0	3	26	9	0	35
Spring '93	11	6	0	17	0	1	0	1	11	7	0	18
Total	35	14	0	49	2	2	0	4	37	16	0	53
1993												
Fall '93	16	11	0	27	1	1	0	2	17	12	0	29
Spring '94	5	1	0	6	0	0	0	0	5	1	0	6
Total	21	12	0	33	1	1	0	2	22	13	0	35
1994												
Fall '94	18	19	0	37	4	2	1	7	22	21	1	44
Spring '95	6	0	0	6	0	0	0	0	6	0	0	6
Total	24	19	0	43	4	2	1	7	28	21	1	50
1995												
Fall '95	13	16	0	29	2	5	0	7	15	21	0	36
Spring '96	11	1	0	12	0	0	0	0	11	1	0	12
Total	24	17	0	41	2	5	0	7	26	22	0	48

Table 1 Continued

Regulatory year	Hunter Kill				Non-hunting Kill				Total reported kill			
	Male	Female	Unk	Total	Male	Female	Unk	Total	Male	Female	Unk	Total
1996												
Fall '96	19	10	1	30	3	0	2	5	22	10	3	35
Spring '97	12	5	0	17	1	0	0	1	13	5	0	18
Total	31	15	1	47	4	0	2	6	35	15	3	53
1997												
Fall '97	20	17	0	37	8	4	0	12	28	21	0	49
Spring ' 98	21	7	0	28	8	0	1	1	21	7	1	29
Total	41	24	0	65	8	4	1	13	49	28	1	78

Table 2 Unit 17 brown bear harvest by subunit, 1991/92–1997/98

Regulatory year	Unit 17(A) M	F	Unk	Total	17(B) M	F	Unk	Total	17(C) M	F	Unk	Total	Unit 17 total M	F	Unk	Total
1991/92	2	2	0	4	18	12	2	32	6	3	0	9	26	17	2	45
1992/93	1	3	0	4	21	7	0	28	13	4	0	17	35	14	0	49
1993/94	1	2	0	3	16	6	0	22	4	4	0	8	21	12	0	33
1994/95	0	3	0	3	17	13	0	30	7	3	0	10	24	19	0	43
1995/96	1	3	0	4	15	11	0	26	8	3	0	11	24	17	0	41
1996/97	3	0	0	3	18	9	1	28	11	6	0	17	31	15	1	47
1997/98	3	0	0	3	27	18	0	45	11	6	0	17	41	24	0	65

Table 3 Unit 17 brown bear successful hunter residency, 1991/92–1997/98

Regulatory year	Local[a] resident (%)	Nonlocal resident (%)	Nonresident (%)	Total successful hunters[b]
1991/92	5 (11.1)	2 (4.4)	38 (84.4)	45
1992/93	8 (16.3)	4 (8.1)	35 (71.4)	49
1993/94	2 (6.0)	2 (6.0)	28 (84.8)	33
1994/95	4 (9.3)	2 (4.7)	37 (86.0)	43
1995/96	1 (2.4)	9 (21.9)	31 (75.6)	41
1996/97	4 (8.5)	4 (8.5)	39 (83.0)	47
1997/98	1 (1.5)	9 (13.9)	55 (84.6)	65

[a] residents of Game Management Unit 17.

[b] total may be higher than the sum of the columns due to hunters of unknown residency.

Table 4 Unit 17 brown bear harvest chronology percent by season, 1991/92–1997/98

Regulatory year	Fall Season			Spring Season				Total
	Sep 1–15	Sep 16–30	Oct 1–15	Apr 1–15	Apr 16–30	May 1–15	May 16–30	
1991/92[a]	6.7%	53.3%	11.1%	----	----	11.1%	15.6%	45
1992/93[a]	12.2%	46.9%	6.1%	----	----	20.4%	14.3%	49
1993/94[a, b]	9.1%	48.5%	24.2%	----	----	6.1%	12.1%	33
1994/95[a,b]	11.6%	58.1%	16.3%	----	----	4.7%	9.3%	43
1995/96[a,b]	9.8%	48.8%	12.2%	----	----	14.6%	14.6%	41
1996/97[b,c]	6.4%	34.0%	23.4%	----	----	17.0%	19.2%	47
1997/98[b,c]	7.7%	30.8%	18.5%	----	21.5%	13.9%	7.7%	65

[a] Season dates: Spring - Unit 17 May 10–May 25
Fall - Units 17A & C Sep 10 - Oct 10
Unit 17B Sep 20 - Oct 10

[b] Season dates for 1993/94 are the same as 1990/91–1992/93 with the following addition:

Western Alaska Brown Bear Management Area (including 17A and that portion of 17B that drains into Nuyakuk and Tikchik Lakes) Sep 1–May 31

[c] Season dates: Spring - Unit 17 April 15 - May 25

Fall - Units 17(A)&(C) Sep 10 - Oct 10
Unit 17(B) Sep 20 - Oct 10

Table 5 Unit 17 brown bear harvest percent by transport method, 1991/92–1997/98

Regulatory year	Percent of harvest									
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Walk	Unknown	Total
1991/92	80.0	---	15.5	---	---	---	---	---	4.4	45
1992/93	83.6	---	14.2	---	---	---	---	2.0	---	49
1993/94	81.8	---	15.1	---	---	---	---	3.0	---	33
1994/95	83.7	---	16.3	---	---	---	---	---	---	43
1995/96	92.7	---	4.9	---	---	---	2.4	---	---	41
1996/97	78.7	---	17.0	---	---	---	2.1	---	2.1	47
1997/98	75.4	---	18.5	---	4.6	---	---	1.5	---	65

LOCATION

GAME MANAGEMENT UNIT: 18 (42,000 mi^2)

GEOGRAPHIC DESCRIPTION: Yukon-Kuskokwim Delta

BACKGROUND

Brown/grizzly bears are at moderate density, and the population is stable in Unit 18. Highest densities are in the Kilbuck Mountains southeast of Bethel and in the Andreafsky Mountains/Nulato Hills north of the Yukon River. Few bears are reported harvested.

The lack of reliable harvest information, except from hunters hunting under general regulations, and a lack of population data warranted development of a reliable method to collect missing data. To address harvest data, we have used a less intrusive method of gathering subsistence brown bear information through village harvest monitors, and to collect brown bear population and density data, we selected a representative study area in the southwestern portion of Unit 18, where the department is continuing a capture-recapture effort for monitoring bear populations.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain a brown bear population that will sustain an annual harvest of 30 bears composed of at least 50% males.
- Minimize adverse interactions between bears and the public.
- Continue to develop subsistence brown bear hunting regulations and harvest assessment techniques that are supported by both the local village councils and the U.S. Fish and Wildlife Service (FWS).
- Develop a cooperative management plan for the Unit 18 brown/grizzly bear population within the Western Alaska Brown Bear Management Area (WABBMA) in cooperation with the FWS and local villages within the management area to better estimate brown bear populations.

MANAGEMENT OBJECTIVES

- Monitor harvests through the sealing program, harvest reports from WABBMA registration permit holders, village harvest monitors, and contacts with the public.
- Improve compliance with brown bear hunting regulations and brown bear harvest reporting requirements.
- Inform the public of methods to minimize bear-human conflicts. Reducing garbage and food/bear interactions will reduce confrontations.

- Meet with Association of Village Council Presidents (AVCP), subsistence brown bear hunters, and FWS to regulate bear hunting and to gather brown/grizzly bear harvest information. We will achieve this by using WABBMA regulations, a cooperative management plan, and cooperative harvest monitoring techniques.

- Coordinate with FWS biologists from the Yukon Delta National Wildlife Refuge (YDNWR) and the Togiak National Wildlife Refuge (TNWR) to implement a study plan using mark-recapture techniques to estimate the brown bear densities in Unit 18. Cooperate with local village councils, the AVCP, and the FWS in developing techniques to monitor grizzly bear populations within the WABBMA and Unit 18.

METHODS

A meeting was held 18–19 May 1998 with FWS refuge staff and department management staff to review the future of cooperative brown bear research within the YDNWR, TNWR, and portions of Units 17B and 18. We discussed the late spring 1998 attempt to use existing collared bears to estimate the population. We also discussed the fact that the WABBMA has grown to include 62 villages and the new villages are not yet represented within the group.

We continued the cooperative project with FWS and the Bureau of Land Management (BLM) to study brown bear density, movements, and population parameters in southwestern Alaska, which began in 1993. Methods used in this effort are found in the summary of capture-recapture techniques for bears developed by Miller et al. (1987). In response to opposition from the public regarding capturing and handling animals, the collaring effort during this reporting period was reduced significantly. Twenty-three female radiocollared bears are still on the air. We participated with cooperating agencies in radiotracking flights to locate collared bears.

We attempted a census of the bears in the study area in the Kilbuck Mountains in early June 1998. Because we were losing collared bears through mortality and collar failures and because collaring more bears continues to be problematic, we felt that a census at this time was viable. However, the results of the survey were not meaningful due to a combination of many factors, including poor weather, the low number of collars, no male bears were collared, and late emergence of bears from dens in 1998.

We sent letters to all subsistence brown bear hunters who registered to hunt in the WABBMA during the 1996–1997 and the 1997–1998 regulatory years. This was a continuing attempt by the department to gather unitwide subsistence brown bear harvest data. Each brown bear legally harvested under the general hunting regulations or killed in defense of life or property (DLP) in the unit was sealed, the skull measured, and sex determined, and a premolar extracted. At the time of sealing, we record data on hunter residency, number of days hunted, date and location of kill, and mode of transportation. When possible, we investigate circumstances surrounding DLP and illegal kills.

Village leaders, hunters, and law enforcement personnel were contacted in an effort to minimize bear-human conflicts at camps and dumps. Reports of illegal activities were relayed to the Department of Public Safety, Division of Fish and Wildlife Protection.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The bear population appears stable, although statistically valid bear density estimates have not been made in Unit 18. Density estimates are possible using a modified capture-recapture technique (Miller et al. 1987). However, for an accurate, statistically valid estimate, approximately 50% of the population must be marked. This level of collaring was not achieved due to local opposition and was a factor in our inability to obtain a population estimate from our spring 1998 census.

Population Size

Population size estimates must be viewed with caution until a statistically valid estimate is completed in Unit 18. Based on information from previous reporting periods and assessments of available habitat, between 500–700 grizzly bears may occur in Unit 18.

Distribution and Movements

Salmon streams in Unit 18, such as the Kisaralik and Kwethluk Rivers in the Kilbuck Mountains and the Andreafsky River north of St. Mary's, support greater brown bear densities than elsewhere in the unit. Lowland habitats along the forested riparian corridors of the Yukon River and tributaries of the Kuskokwim River contain moderate densities of brown bears. Other lowland habitats, including the vast treeless lowland of the Y-K Delta, contain very few bears.

MORTALITY

Harvest

Season and Bag Limit.

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts	Nonresident Open Season
Unit 18 – General Hunt		
Resident Hunters: 1 bear every four regulatory years	10 Sep–10 Oct 10 Apr–25 May (General hunt only)	
Nonresident Hunters: 1 bear every four regulatory years		10 Sep–10 Oct 10 May–25 May (General hunt only)
Unit 18 – Subsistence Hunt		
Resident Hunters: 1 bear per regulatory year by registration permit in the WABBMA for subsistence	1 Sep–31 May (Subsistence hunt only)	

purposes

Nonresident Hunters:	No open season (Subsistence hunt only)

Board of Game Actions and Emergency Orders. The Board of Game reauthorized the brown bear tag fee exemption associated with the WABBMA subsistence bear permit. There were no other changes made to bear seasons and bag limits during this reporting period.

However, there were changes made to the boundaries of the WABBMA. The original boundary of the WABBMA included all of Unit 18 and that portion of Unit 19 downstream from and including the Aniak Drainage, Unit 17A, and that portion of Unit 17B draining into the Nuyakuk and Tickchik Lake. This area remained the same through the 1996–1997 hunting season. For the 1997–1998 hunting season, all of Unit 17 and Unit 9B were added to the WABBMA.

Hunter Harvest. During the 1996–1997 regulatory year, the reported harvest was 4 bears (0 subsistence and 4 general season) and during 1997–1998, the reported harvest was 4 bears (0 subsistence and 4 general season).

Unreported harvest includes both DLP and bears taken for subsistence purposes but outside the subsistence regulations. The subsistence harvest is localized in a few westward drainages of the Kilbuck Mountains, the Andreafsky-Atchuelinguk drainages, and the Kanektok-Goodnews drainages. This subsistence harvest averages 10–20 bears in years with good spring snow conditions. Subsistence harvest is estimated between zero and 10 bears in years when access is limited by snowpack in the spring and low water in the fall.

The DLP harvest is normally during the closed season, so it is often unreported to authorities. The DLP kills are near infrequently attended fish camps and open landfills. All Unit 18 communities have open landfills that attract bears during the spring, summer, and fall. Residential garbage, dog food, and fish-drying racks bring bears close to humans. Most local residents have a low tolerance for bears near their villages and fish camps. Because of these unreported kills, caution must be used interpreting data based solely on reported harvest. No DLP kills and only 3 illegal brown bear kills are documented for Unit 18 during this period.

Hunter Residency and Success. During the 1996–1997 regulatory year, 4 nonresidents harvested brown bears under the general hunting regulations. During 1997–1998, 2 residents and 2 nonresidents harvested bears. No bears were reported harvested under subsistence regulations during 1996–1997 and 1997–1998.

No data for unsuccessful hunters under general hunt regulations were recorded for the reporting period, so success rates could not be calculated.

Of the 57 WABBMA permits issued for 1996–1997, 28 permittees reported their hunts. Of these, 16 did not hunt and 12 reported hunting bears. No bears were reported harvested. Of the 43 WABBMA permits issued for 1997–1998, 16 permittees reported their hunts. Of these, 10 did not hunt while 6 reported hunting bears. Again, no bears were reported harvested.

Harvest Chronology. In 1996–1997 1 bear was taken in the fall, and 3 were harvested in spring; in 1997–1998 3 bears were taken in the fall, and 1 was harvested in spring. All of these bears were taken under the general hunt regulations.

Transport Methods. Four guided nonresident hunters used aircraft for transportation, and 1 used a boat. One nonresident hunter did not report his method of transportation. One resident hunter used a boat for transportation, and the other used an ATV. Most of the subsistence hunters in the Goodnews Bay, Platinum, Marshall, and Quinhagak areas used snowmachines to hunt bears, especially during spring. Opportunistic hunting for brown bears may occur along the Kwethluk, Kisaralik, Kanektok and Goodnews drainages during moose and caribou hunting seasons.

Other Mortality

We have no specific information on natural mortality of brown bears in Unit 18.

HABITAT

Habitat Assessment

Unit 18 contains approximately 14,000 km^2 of fair to excellent brown bear habitat in the Kilbuck and Andreafsky Mountains. Additional lowland riparian habitats surrounded by tundra, support moderate densities of brown bears along the Yukon River and tributaries of the Kuskokwim. Most brown bear habitat in Unit 18 is protected by the YDNWR, and land status is not expected to change.

CONCLUSIONS AND RECOMMENDATIONS

Lack of objective data on the brown bear population and little information on nonhunting mortality make effective management difficult. It is important to collect accurate bear population information with increasing local human populations, both within and outside Unit 18.

Since 1993 there has been a concerted effort to assess the parameters of the grizzly bear population in Unit 18, especially in the Kilbuck Mountains. Continued opposition to collaring animals from local residents has prevented statistically significant population estimates. However, the large amount of work done with bears to date has provided managers with a better, more helpful, understanding of the population. Given the political realities in Unit 18, changing management priorities, and the lack of funds for bear studies, it may be impossible to reach our goal of objective population data for brown bears.

The nature of alternative wildlife resources in Unit 18 has changed in recent years. The arrival of large numbers of Mulchatna caribou has provided an alternate source of red meat, and interest in hunting bears for food has declined, at least in the short term.

We should continue efforts to encourage local residents to report all bear kills. Wildlife managers currently rely on harvest statistics derived from mandatory sealing and harvest reporting requirements to evaluate trends in bear populations. Inaccurate and incomplete harvest statistics continue to be a problem. We should continue efforts to develop reliable, accurate, and repeatable techniques for gathering subsistence brown bear harvest information.

LITERATURE CITED

MILLER SD, EF BECKER, AND WB BALLARD. 1987. Black and brown bear density estimates using modified capture-recapture techniques in Alaska. International Conference on Bear Research and Management. 7:23–25.

PREPARED BY:

Roger Seavoy
Wildlife Biologist II

SUBMITTED BY:

Peter J Bente
Survey-Inventory Coordinator

LOCATION

GAME MANAGEMENT UNITS: 19, 21A and 21E (59,756 mi^2)

GEOGRAPHIC DESCRIPTION: All Drainages of the Kuskokwim River upstream from the village of Lower Kalskag; Yukon River drainage from Paimiut upstream to, but not including, the Blackburn Creek drainage; the entire Innoko River drainage; and the Nowitna River drainage upstream from the confluence of the Little Mud and Nowitna Rivers.

BACKGROUND

Although grizzly bears are distributed throughout Units 19, 21A, and 21E, densities and interest in sport harvest varies. In higher elevations within the Alaska Range and associated foothills (Units 19B and 19C), there is moderate harvest pressure, mainly from nonresident-guided hunters. Harvest pressure is generally light in other portions of the units.

We have no population estimates in this area; thus, densities are only speculative. Harvests have generally fluctuated with season lengths and probably do not provide a good indication of population status or trend. During the first decade following mandatory sealing requirements, harvest was light, averaging about 15 bears annually. During the 1970s, harvest increased dramatically, but seasons were shortened severely, and as a result harvest declined by the early 1980s. Throughout the 1980s, harvests remained relatively low, with a slowly increasing trend until the early 1990s.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

There are several management goals for grizzly bears in Units 19, 21A, and 21E. The goal for that portion of Units 19D and 19A north of the Kuskokwim River and for Units 21A and 21E is to provide the greatest sustained opportunity to hunt brown bears. In Unit 19C the goal is to provide an opportunity to hunt brown bears under aesthetically pleasing conditions. In Units 19A and 19B south of the Kuskokwim River and upstream from Aniak River drainage, the primary goal is to provide the opportunity to take large brown bears; the secondary goal in this area is to provide the opportunity to hunt brown bears under aesthetically pleasing conditions. Finally, the western portion of Units 19, 21A, and 21E encompasses part of the Western Alaska Brown Bear Management Area where the goal is to provide subsistence uses of bears.

MANAGEMENT OBJECTIVES

- Manage brown bear populations to sustain a mean annual harvest of no more than 70 bears with a minimum of 50% males in the harvest.

- Allow an increased legal harvest of brown bears in and around villages, fish camps, and other human habitations during open seasons to reduce human/bear conflicts during closed seasons.

METHODS

Sealing bears in the area provided data on hunter demographics, harvest rate, sex ratio of the harvest, and timing and location of harvest. Information regarding harvests in the western Alaska brown bear management area was also compiled. Harvest data were summarized by regulatory year (RY = 1 July–30 June)

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size and Composition

We completed no population surveys or censuses. However, I estimated the population based on known bear densities (Miller et al. 1997) in similar habitats in other game management units in Interior Alaska. Unit 19A has medium quality habitat (20 bears/1000 mi^2 = 200 bears). Unit 19B probably contains about 7500 mi^2 of the best bear habitat in the area (40 bears/1000 mi^2 = 300 bears). Unit 19C has about 5200 mi^2 of good habitat (40 bears/1000 mi^2 = 210 bears) and about 1500 mi^2 of medium habitat (20 bears/1000 mi^2 = 30 bears). Unit 19D generally contains poor habitat (13 bears/1000 mi^2 = 165 bears). Using these figures, my estimate was 900–1000 bears for Unit 19. Pegau (1987) estimated 900 bears.

I made a similar population estimate for Units 21A and 21E. The higher elevation areas are moderately good bear habitat, and low elevation areas are poor habitat. I used an estimated density of 25 bears/1000 mi^2 in moderately good bear habitat and 10 bears/1000 mi^2 in poor habitat. In Unit 21A there is about 4500 mi^2 of moderately good habitat (25 bears/1000mi^2 = 113 bears) and about 11,500 mi^2 of poor habitat (10 bears/1000 mi^2 = 115 bears). The total population estimate for Unit 21A was therefore 225–275 bears. Unit 21E consists of about 1000 mi^2 of moderately good habitat (25 bear/1000mi^2 = 25 bears) and about 7000 mi^2 of poor habitat (10 bear/1000 mi^2 = 70 bears). The total estimate for Unit 21E was 90–125 bears.

My estimate for the 60,352-mi^2 area was 1200–1400 bears, a density of 20–23 bears/1000 mi^2. The population was probably stable or slowly increasing during the past 10 years, based on field observations, nuisance reports, and hunter harvest and sightings.

MORTALITY

Season and Bag Limit.

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Units 19A and 19B within the Western Brown Bear Management Area.		
One bear every regulatory year by registration permit.	1 Sep–31 May (Subsistence hunt only)	No open season
One bear every 4 regulatory years.	1 Sep–31 May	1 Sep–31 May
Unit 19A outside the Western Brown Bear Management Area. One bear every 4 regulatory years.	1 Sep–31 May	1 Sep–31 May
Unit 19B outside the Western Brown Bear Management Area. One bear every 4 regulatory years	10 Sep–25 May	10 Sep–25 May
Units 19C, and 19D. One bear every 4 regulatory years.	1 Sep–31 May	1 Sep–31 May
Units 21A and 21E. One bear every 4 regulatory years.	1 Sep–31 May	1 Sep–31 May

Board of Game Actions and Emergency Orders. At the spring 1998 Board of Game meeting, the McGrath Advisory Committee submitted a proposal to delete the $25 brown tag fee for residents in Unit 19D. We supported an amended version, which included mandatory in-unit sealing to deter bootlegging from other units. The board adopted the proposal. During the spring 1999 meeting, the board reauthorized this tag fee exemption. Tag fee exemptions must be reauthorized each year by the board.

Hunter Harvest. Human use of the grizzly bear population was moderate (Table 1). There has been an increasing harvest trend for Units 19A, 19B, and 19C over the last 4 years. The Unit 19A average harvest during RY 1989–1990 through 1993–1994 was 4.2 bears/year, and during RY 1994–1995 through 1997–1998 the average increased to 8.0 bears/year. In Unit 19B the RY 1989–1990 through 1993–1994 average harvest was 20.2 bears/year. It increased to 22.8 bears/year from RY 1994–1995 through 1997–1998. In Unit 19C the RY 1989–1990 through 1993–1994 average harvest was 13.6 bears/year. It increased to 17.5 bears/year from RY 1994–1995 through 1997–1998. In Unit 19D harvest decreased from 3.4 bears/year during RY 1989–1990 through 1993–1994 to 1.2 bears/year during RY 1994–1995 through 1997–1998. Unit 21A and 21E harvests have remained low and stable since RY 1989–1990, with Unit 21A averaging 1.3 bears/year and Unit 21E averaging 1.2 bears/year. The number of bears taken at fish camps and not reported was unknown, but it was probably ≤10 bears/year.

The 5-year mean annual harvest (RY 1993–1994 through 1997–1998) in the entire area was 54 grizzly bears (about 4.4% of the total population/year). My conservative sustainable harvest was 70–85 bears (6% of 1200–1400 bears) (Reynolds 1997). The harvests were below sustainable levels.

Generally, the proportion of males in the reported harvest has been near 60% (Table 2). It was <50% (44%) during only 1 of the past 10 seasons (spring 1997). The mean for the past 5 years was 62%. It varied from a low of 52% (RY 1996–1997) to a high of 72% (RY 1997–1998).

Generally, we assume that a preponderance of males in the harvest reflects a healthy population, given low to moderate hunting pressures. However, many Unit 19, 21A, and 21E grizzly bears are harvested on multispecies hunts, and hunters are not necessarily attempting to take a record-class animal. Therefore, harvest of females (except those with cubs or yearlings) is not avoided. Until grizzly bear hunting effort becomes more intensive, our management objective to harvest >50% males should afford protection needed to sustain the population.

Hunter Residency and Success. During the past 5 years, nonresidents of the state harvested 221 of 265 bears (83%) (Table 3). This indicates the relatively high use of the resource by guides and their nonresident clients. No information is available on success rates (i.e., number successful versus unsuccessful) by brown bear hunters in the unit. However, the mean number of days hunted for successful hunters annually between 1993 and 1997 fluctuated between 4.5 and 6.2 days.

Harvest Chronology. Most harvest occurred during fall (77%) (Table 4). The fall harvest was greater primarily due to guided hunts for multiple species. Guided hunters opportunistically kill bears while hunting ungulates. The amount of spring hunting for bears in this area was low.

Transport Methods. During the past 5 years, 79–100% of successful hunters used airplanes as their primary access method (Table 5). This percentage has not changed significantly since sealing began.

CONCLUSIONS AND RECOMMENDATIONS

Seasons and bag limits allowed a moderate brown bear harvest, and there was no harvest data evidence indicating a decline in the population. Therefore, additional harvest restrictions seem unnecessary. However, following the tag-fee exemption, authorized by the Board of Game in 1998, close scrutiny of Unit 19D harvest data must occur annually, and changes should be enacted if warranted. Brown bear predation on moose, caribou, and bison was probably not a widespread problem in the area (Jack Whitman, personal communication).

Annual review of sealing certificate data will continue. If sex ratios in the harvest begin to favor females, changes in season lengths should be considered. We will also continue to stress the need to document harvests during personal contacts in villages and fish camps, whether harvests are legal or taken under defense of life or property regulations. Compliance with reporting requirements by local residents is low because of the present regulation requiring a $25 resident

brown bear tag (except for resident hunting in the Western Alaska Brown Bear Management Area and in Unit 19D).

We met our management objective to sustain a mean annual harvest of no more than 70 bears with a minimum of 50% being males. We made progress increasing the reporting of locally taken bears; the Unit 19D tag-fee exemption will probably aid in accomplishing this objective. I expect more public proposals for tag-fee exemptions, with good justifications for implementation in some areas.

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PREPARED BY:

Toby A Boudreau
Wildlife Biologist III

SUBMITTED BY:

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Harry V Reynolds, III
Wildlife Biologist III

Table 1 Units 19, 21A, and 21E grizzly bear harvest, regulatory years 1989–1990 through 1997–1998

Regulatory	Unit 19 subunits					Unit 21 subunits		
year	A	B	C	D	Unk	A	E	Total
1989–1990	0	15	16	3	0	3	3	40
1990–1991	2	15	14	7	0	2	3	43
1991–1992	4	18	9	2	0	0	5	38
1992–1993	11	28	15	4	0	2	5	65
1993–1994	4	25	14	1	0	0	4	48
1994–1995	8	25	15	2	0	3	4	58
1995–1996	6	29	18	1	1	0	2	57
1996–1997	9	13	19	2	0	2	3	48
1997–1998	9	24	18	0	0	0	6	57
Total	53	192	139	22	3	12	11	454
$\bar{x}$	5.8	21.3	15.4	2.4	0.1	1.3	3.9	50.44

Table 2 Units 19 and 21A and 21E grizzly bear harvest by type of kill, regulatory years 1993–1994 through 1997–1998

Regulatory	Hunter kill				Nonhunting kill				Total reported kill				
year	M	F	Unk	Total	M	F	Unk	Total	M	(%)	F	(%)	Total
1993–1994													
Fall 1993	20	18	0	38	0	0	0	0	20	(54)	18	(46)	38
Spring 1994	9	1	0	10	0	0	0	0	9	(71)	1	(29)	10
Total	29	19	0	48	0	0	0	0	29	(57)	19	(43)	48
1994–1995													
Fall 1994	24	18	1	43	0	0	0	0	24	(58)	18	(42)	43
Spring 1995	12	3	0	15	0	0	0	0	12	(67)	3	(33)	15
Total	36	21	1	58	0	0	0	0	36	(59)	21	(41)	58
1995–1996													
Fall 1995	29	18	1	48	0	0	0	0	29	(61)	18	(39)	48
Spring 1996	5	4	0	9	0	0	0	0	5	(71)	4	(29)	9
Total	34	22	1	57	0	0	0	0	34	(63)	22	(37)	57
1996–1997													
Fall 1996	18	14	0	32	0	0	0	0	18	(56)	14	(44)	32
Spring 1997	7	9	0	16	0	0	0	0	7	(44)	9	(56)	16
Total	25	23	0	48	0	0	0	0	25	(52)	23	(48)	48
1997–1998													
Fall 1997	30	15	0	45	0	0	0	0	30	(66)	15	(34)	45
Spring 1998	11	1	0	12	0	0	0	0	11	(92)	1	(8)	12
Total	41	16	0	57	0	0	0	0	41	(72)	16	(28)	57

Table 3 Units 19, 21A, and 21E grizzly bear successful hunter residency and effort, regulatory years 1993–1994 through 1997–1998

Regulatory year	Resident	(%)	Nonresident	(%)	Unk	Mean effort for successful hunters (days)	Total successful hunters
1993–1994	8	(17)	40	(83)	0	4.5	48
1994–1995	17	(30)	40	(70)	1	5.3	58
1995–1996	8	(14)	47	(86)	2	6.2	57
1996–1997	5	(10)	43	(90)	0	6.0	48
1997–1998	6	(11)	51	(89)	0	4.7	57

Table 4 Units 19, 21A and 21E grizzly bear harvest chronology percent by time period, regulatory years 1993–1994 through 1997–1998

Regulatory year	Month of harvest						
	Sep	Oct	Nov	Apr	May	Other	*n*
1993–1994	73	6	0	4	8	8	48
1994–1995	67	7	0	12	12	2	58
1995–1996	84	0	0	11	5	0	56
1996–1997	63	4	0	6	27	0	48
1997–1998	75	4	0	16	5	0	57

Table 5 Units 19, 21A, and 21E grizzly bear harvest percent by transport method, regulatory years 1993–1994 through 1997–1998

Regulatory year	Percent by transport method									
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Walk	Unk	*n*
1993–1994	82	4	2	0	6	2	0	4	0	48
1994–1995	91	4	0	0	4	0	0	1	0	55
1995–1996	100	0	0	0	0	0	0	0	0	57
1996–1997	94	0	4	2	0	0	0	0	0	48
1997–1998	79	0	2	5	10	0	0	2	2	57

LOCATION

GAME MANAGEMENT UNIT: 20A, 20B, 20C, 20F, and 25C (39,228 mi^2)

GEOGRAPHIC DESCRIPTION: Central and Lower Tanana Valley, and Middle Yukon River drainages

BACKGROUND

Grizzly bears are throughout this area, with higher densities in the mountainous portions of Units 20A and 20C. We initiated a long-term grizzly bear research project in Unit 20A in 1981 to 1) gather baseline data on population status and reproductive biology (1981–1985; Reynolds and Hechtel 1986) and 2) to study the effects of high exploitation rates on grizzly bear population dynamics (1986–1991; Reynolds and Boudreau 1992; Reynolds 1993). During the second phase of the project, the grizzly bear population was deliberately subjected to high harvest levels (≥11% of the population versus ≤6% before 1981). As a result, Reynolds (1993) documented a 20% decline in the bears (≥2 years old) in this area since 1981. The current phase of the study examines population recovery (Reynolds 1996). Accordingly, the Board of Game reduced season length to increase recruitment and survival of female bears.

Regulations prevent the harvest of grizzly bears within the Denali National Park portions of Unit 20C resulting in low harvests in that unit. The eastern half of Unit 20B supports a moderate density of grizzly bears, and harvests are highest in that portion. Grizzly bears inhabit the remainder of the area at lower densities, resulting in low harvests.

Ballard et al. (1981) and Gasaway et al. (1992) identified grizzly bears as significant predators of moose in Units 13 and 20E, respectively. However, Gasaway et al. (1983) determined that grizzly bears played little role in the dynamics of moose within the Tanana Flats portion of Unit 20A, and Miller and Ballard (1992) were unable to detect changes in moose calf survivorship during periods when bear numbers were reduced in Unit 13. Grizzly bears probably influence moose population dynamics in parts of the study area at different times. Valkenburg (1997) identified grizzly bears as important predators of neonates from Unit 20A's Delta caribou herd.

During the 1980s, McNay (1990) noted increasing numbers of hunters and increased interest in hunting grizzly bears. Subsequently, McNay (1990) analyzed harvest and population data from this study area to develop specific management and harvest objectives. He based harvest objectives on a sustainable harvest rate of 8% of the population ≥2 years of age (Miller 1990).

In this report, we analyzed grizzly bear harvest data for both regulatory and calendar years. Many of our objectives are age-specific. Analysis by regulatory year creates difficulties because a cohort passes through 2 age classes within a single regulatory year (RY = 1 July–30 June).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

All subunits

- Maintain healthy grizzly populations and the ecosystems upon which they depend.
- Provide people with an opportunity to hunt, view, and photograph grizzly bears.
- Avoid human-grizzly bear interactions that threaten human life and property.

Additionally in Unit 20A

- Provide for scientific and educational use of grizzly bears.

Additionally in Unit 20C

- Maintain a grizzly bear population within Denali National Park that is largely unaffected by human activity and that is not subjected to hunting.

MANAGEMENT OBJECTIVES

Unit 20A Mountains

- Decrease human-caused grizzly bear mortality by managing for a 3-year mean annual human-caused mortality of no more than 3% of the adult females (≥6 years old) and no more than 6% of the bears ≥2 years old.
- Cooperate with a research project (Reynolds 1996) whose objectives are listed:
  - Determine the length of time necessary for recovery or stabilization of a reduced grizzly bear population following reductions in human-caused mortality rates.
  - Measure the recovery responses in the dynamics of the population, especially female population size, total population size, and production and survival of offspring.

Eastern half of Unit 20B

- Manage human-caused grizzly bear mortality to provide a stable population with a 3-year mean annual human-caused mortality of up to 6 bears ≥2 years old, with an average of at least 55% males.

Unit 20C within the original boundaries of Denali National Park

- Maintain a closed season on grizzly bear hunting.

Unit 20A Flats, western half of Unit 20B, Unit 20C outside Denali National Park, and all of Units 20F and 25C

- Manage human-caused mortality in the combined area to provide stable grizzly bear populations with a 3-year mean annual human-caused mortality of no more than 26 grizzly bears ≥2 years old, with an average of at least 55% males.

- Manage the 3-year mean annual human-caused grizzly bear mortality from individual areas with the following harvest objectives: no more than 3 bears from Unit 20A Flats, 3 from the western half of Unit 20B, 7 from Unit 20C, 7 from Unit 20F, and 6 from Unit 25C.

METHODS

HARVEST

We used grizzly bear sealing certificates for data on date and location of kill, sex, skull size, hunter residency, transportation method, kill type (hunter harvest, illegal kill, research mortality, defense of life or property, etc.), and commercial services. We coded sealing certificates according to Uniform Coding Units (UCU). During sealing, we collected premolars for age determination. Department staff sealed most of the grizzly bears harvested in this study area in the regional office in Fairbanks.

We analyzed data relevant to age-specific objectives by calendar year to avoid confusion regarding age-class. We based all other analyses on regulatory years.

POPULATION SIZE AND DENSITY

In June 1993, H Reynolds and R Eagan (Eagan 1995) categorized UCUs in Units 20A, 20B, 20C, 20F, and 25C into 4 grizzly bear density strata: low, medium, high, and super. The low-density stratum consisted of areas with significant human development, poorly drained soils (or permafrost) and black spruce. The medium-density stratum included upland forest and tundra habitats at elevations generally between 500 and 1500 ft. The high-density stratum consisted of upland foothills and mountainous areas similar to areas of known density in Units 20A, 20E, and 13E. The super-density stratum included habitat similar to the high-density areas, but where no harvest was permitted.

The total area within each stratum excluded glaciers and land above 6000 ft. Approximately 500 mi^2 (1300 km^2) was excluded from the high-density stratum, and 386 mi^2 (1000 km^2) was excluded from the super stratum. Population size was estimated using extrapolations from stratum densities of low, 3–8 bears/1000 mi^2 (1–3 bears/1000 km^2); medium, 13–26 bears/1000 mi^2 (5–10 bears/1000 km^2); high, 36–44 bears/1000 mi^2 (14–17 bears/1000 km^2); and super, 52–78 bears/1000 mi^2 (20–30 bears/1000 km^2).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Unit 20A. Eagan (1995) classified the mountainous portion of Unit 20A as high density based on results from research in the central foothills (Reynolds 1993). High harvest rates intentionally resulted in reduced bear numbers in this portion of Unit 20A during phase 2 of the research. Phase 3 monitors recovery of the population. We expected the number of female adult bears to meet prereduction levels by 1998. However, numbers were still slightly low by the 1998 Board of Game meeting. By the next meeting in March 2000, female adult bear numbers will likely reach prereduction levels (Reynolds 1996). If further data confirms this trend, we will address restoring the original fall seasons during the next Board of Game cycle.

The Tanana Flats in Unit 20A provide relatively poor grizzly bear habitat, resulting in low densities. Some grizzly bears on the Tanana Flats are probably dispersers, or bears making temporary forays onto the flats. Eagan (1995) estimated that the flats provide habitat for 20 grizzly bears, or 6.5 bears/1000 mi^2 (2.5 bears/1000 km^2).

Unit 20B. Eagan (1995) classified most of Unit 20B as low density because of the moderate habitat, high density of people, and good access. Better habitat in the Sawtooth Mountains in the western portion was classified as low-density stratum because of good access and human activity. The upper Chena and Salcha Rivers rated medium density because of the better habitat and relative inaccessibility.

Unit 20C. Eagan (1995) classified the mountainous portion of Unit 20C into the super stratum (52–78 bears/1000 mi^2 [20–30 grizzly bears/1000 km^2]). Although Dean (1987) estimated 88 bears/1000 mi^2 (34 bears/1000 km^2) for a portion of this area in 1983, he surveyed the area along the Denali Park Road that includes the best habitat. Eagan (1995) assumed lower densities for the remainder of the mountainous portions of Unit 20C, based on densities Reynolds (1993) documented in Unit 20A in 1981.

Eagan (1995) classified a small portion of northwestern Unit 20C as medium density because of higher habitat quality than in the flats. The area also abuts some fair grizzly bear habitat in the upper Kuskokwim drainage.

Eagan (1995) felt the remainder of Unit 20C was low but indicated potential for slightly higher densities than other low areas. The Unit 20C flats have salmon streams and relatively low hunting pressure.

Unit 20F. Although very little information exists, the Tozitna River drainage/Ray Mountains portion of Unit 20F contains relatively good grizzly bear habitat and warranted medium density classification.

Eagan (1995) classified the remainder of Unit 20F as low density due to relatively poor grizzly bear habitat.

Unit 25C. The mountainous portion of Unit 25C was medium density. This is an extension of the medium density area of eastern Unit 20B and also includes the White Mountains. Although good habitat abounds, Eagan (1995) noted that roads and trails are through the area, providing good access. Hunters take grizzly bears incidental to their pursuit of caribou and moose.

All Subunits. Extrapolating from the stratification above, Eagan (1995) estimated that 446–782 grizzly bears (all ages) inhabit the area. Using the midpoint of the population estimate (614 bears), the combined density for the area is about 16.1 bears/1000 mi^2 (6.2 grizzly bears/1000 km^2).

Population Composition

Reynolds (1993, 1996) summarized composition data for his study area in Unit 20A. J Keay (personal communication) collected composition data as part of ongoing research in Denali National Park in Unit 20C.

Distribution and Movements

Reynolds (1996) described movement and dispersal trends for the Unit 20A study area. Females exhibited high fidelity to home ranges and little emigration or immigration (Reynolds 1993).

MORTALITY

Harvest

Season and Bag Limit. In RY 1990–1991 through 1993–1994, the season for grizzly bears was 1 September–31 May with a bag limit of 1 bear every 4 regulatory years. Commensurate with research objectives, for RY 1994–1995 the board shortened the season in Unit 20A by 9 days to 10 September–31 May. All other areas covered in this report retained the 1 September opening. There have been no changes to seasons or bag limits since RY 1994–1995. These seasons and bag limits applied to both resident and nonresident hunters. Sows accompanied by cubs could not be killed.

Harvest by Hunters. Recent harvest in Units 20A, 20B, 20C, 20F, and 25C seems relatively stable (Tables 1a–e). Hunters killed 35 bears in all units during RY 1996–1997 and 25 during RY 1997–1998. Other human-caused mortality (defense of life or property kills, illegal kills, etc.) resulted in 2 bear deaths in RY 1996–1997 and 2 deaths in RY 1997–1998.

Harvest Zones.

Unit 20A Mountains — Harvest included 8 and 10 bears during calendar years 1996 and 1997, respectively (Table 2). We estimate the 3-year (1995–1997) average annual harvest rate was approximately 10% of bears ≥2 years old, assuming Eagan's (1995) population estimates and Reynolds (1993) population structure. Age data for female grizzlies that died from human causes were limited. Consequently, we were not able to determine if we are meeting objectives associated with age structure for female grizzlies that died from human causes.

Eastern half of Unit 20B — The 3-year mean annual mortality of 6 bears ≥2 years of age met our objective for a mean of up to 6 bears/year (Table 2). For 1995–1997 combined, females composed 40% (31 of 78) of the harvest.

Unit 20A Flats, western half of Unit 20B, Unit 20C outside Denali National Park, and all of Units 20F and 25C — In the combined area, humans killed 18 and 14 bears during the 1996 and 1997 calendar years, including 22 males and 8 females all ≥2 years old. The 3-year (1995–1997) mean harvest of 13 bears per year was only 50% of our maximum harvest objective for up to 26 bears. In addition, the mortality included 70% (n = 28) males, which easily met our objective for at least 55% males.

We also met our harvest objectives in individual areas. The 3-year (1995–1997) mean harvest was 3 bears for the Tanana Flats in 20A, 1 for the western half of Unit 20B, 5 for Unit 20C, 1 for Unit 20F, and 2 for Unit 25C.

Hunter Residency and Success. As in previous years, Alaska residents harvested the majority (66%) of the grizzly bears harvested during the last 3 RYs (Table 3).

Harvest Chronology. Hunters harvested bears primarily during the month of September (Table 4).

Transport Methods. The methods of transportation used by successful grizzly bear hunters have not changed substantially in recent years; however, 3- or 4-wheelers became more popular during 1997–1998 (Table 5).

CONCLUSIONS AND RECOMMENDATIONS

We exceeded management objectives for percent harvested in Unit 20A mountains even with the shortened season. However, the population estimates used to calculate the percent harvested was from 1992 census data and the population structure may have changed since that time. Since the recovery phase is at or near completion, we may initiate a proposal in 2000 to return the Unit 20A season start date to 1 September as originally proposed to local advisory committees. However, we will have to thoroughly investigate and communicate the probability that a return to the regular season may indeed decrease bear populations. Areas with high harvest density, such as the Ferry Trail Management Area and the Yanert River drainage, warrant the most consideration.

In addition, we must continue to closely monitor the harvest and population and to encourage the harvest of males over females. Through the next Board of Game meeting in March 2000, we plan to address these issues and our Unit 20A objectives with local advisory committees, research staff, and the Board of Game.

We met objectives for all other areas and make no recommendations at this time.

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PREPARED BY:

Bruce W Dale
Wildlife Biologist III

SUBMITTED BY:

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Harry V Reynolds, III
Wildlife Biologist III

Table 1a Unit 20A grizzly bear harvest, regulatory years 1993–1994 through 1997–1998

Regulatory year	Reported											
	Hunter kill[a]				Nonhunting kill[b]			Total estimated kill[c]				
	M	F	Unk	Total	M	F	Unk	M	F	Unk	Total	% Males
1993–1994												
Fall 1993	4	5	0	9	0	0	0	4	5	0	9	
Spring 1994	5	0	0	10	3	2	0	8	2	0	10	
Total	9	5	0	19	3	2	0	12	7	0	19	63
1994–1995												
Fall 1994	2	4	0	6	0	0	0	2	4	0	6	
Spring 1995	3	1	0	4	0	1	0	3	2	0	5	
Total	5	5	0	10	0	1	0	5	6	0	11	45
1995–1996												
Fall 1995	6	3	0	9	0	0	0	6	3	0	9	
Spring 1996	0	2	0	2	0	0	0	0	2	0	2	
Total	6	5	0	11	0	0	0	6	5	0	11	55
1996–1997												
Fall 1996	4	4	0	8	0	2	0	4	6	0	10	
Spring 1997	1	2	0	3	0	0	0	1	2	0	3	
Total	5	6	0	11	0	2	0	5	8	0	13	38
1997–1998												
Fall 1997	6	4	0	10	0	0	0	6	4	0	10	
Spring 1998	3	0	0	3	0	1	0	3	1	0	4	
Total	9	4	0	13	0	1	0	9	5	0	14	64

[a] Includes illegal kills.

[b] Includes defense of life or property kills, research mortalities, and other known human-caused accidental mortality. These data not included in tables of chronology, transport, etc.

[c] Percentage includes only bears of known sex.

Table 1b Unit 20B grizzly bear harvest, regulatory years 1993–1994 through 1997–1998

Regulatory year	Reported											
	Hunter kill[a]				Nonhunting kill[b]			Total estimated kill[c]				
	M	F	Unk	Total	M	F	Unk	M	F	Unk	Total	% Males
1993–1994												
Fall 1993	0	0	0	0	0	0	0	0	0	0	0	
Spring 1994	1	1	0	2	0	0	0	1	1	0	2	
Total	1	1	0	2	0	0	0	1	1	0	2	50
1994–1995												
Fall 1994	2	1	0	3	0	0	0	2	1	0	3	
Spring 1995	3	1	0	4	0	0	0	3	1	0	4	
Total	5	2	0	7	0	0	0	5	2	0	7	71
1995–1996												
Fall 1995	1	3	0	4	0	0	0	1	3	0	4	
Spring 1996	0	0	0	0	0	0	0	0	0	0	0	
Total	1	3	0	4	0	0	0	1	3	0	4	25
1996–1997												
Fall 1996	4	4	0	8	0	0	0	4	4	0	8	
Spring 1997	1	0	0	1	0	0	0	1	0	0	1	
Total	5	4	0	9	0	0	0	5	4	0	9	56
1997–1998												
Fall 1997	2	1	0	3	0	0	0	2	1	0	3	
Spring 1998	0	1	0	1	0	1	0	0	2	0	2	
Total	2	2	0	4	0	1	0	2	3	0	5	40

[a] Includes illegal kills.

[b] Includes defense of life or property kills, research mortalities, and other known human-caused accidental mortality. These data not included in tables of chronology, transport, etc.

[c] Percentage includes only bears of known sex.

Table 1c Unit 20C grizzly bear harvest, regulatory years 1993–1994 through 1997–1998

Regulatory year	Reported											
	Hunter kill[a]				Nonhunting kill[b]			Total estimated kill[c]				
	M	F	Unk	Total	M	F	Unk	M	F	Unk	Total	% Males
1993–1994												
Fall 1993	0	1	0	1	0	0	0	0	1	0	1	
Spring 1994	0	0	0	0	0	0	0	0	0	0	0	
Total	0	1	0	1	0	0	0	0	1	0	1	0
1994–1995												
Fall 1994	3	3	0	6	2	0	0	5	3	0	8	
Spring 1995	0	0	0	0	0	0	0	0	0	0	0	
Total	3	3	0	6	2	0	0	5	3	0	8	63
1995–1996												
Fall 1995	0	0	0	0	0	0	0	0	0	0	0	
Spring 1996	2	0	0	2	0	0	0	2	0	0	2	
Total	2	0	0	2	0	0	0	2	0	0	2	100
1996–1997												
Fall 1996	3	2	1	6	0	0	0	3	2	1	6	
Spring 1997	2	1	0	3	0	0	0	2	1	0	3	
Total	5	3	1	9	0	0	0	5	3	1	9	63
1997–1998												
Fall 1997	4	0	0	4	0	0	0	4	0	0	4	
Spring 1998	1	0	0	1	0	0	0	1	0	0	1	
Total	5	0	0	5	0	0	0	5	0	0	5	100

[a] Includes illegal kills.

[b] Includes defense of life or property kills, research mortalities, and other known human-caused accidental mortality. These data not included in tables of chronology, transport, etc.

[c] Percentage includes only bears of known sex.

Table 1d Unit 20F grizzly bear harvest, regulatory years 1993–1994 through 1997–1998

Regulatory year	Reported											
	Hunter kill[a]				Nonhunting kill[b]			Total estimated kill[c]				
	M	F	Unk	Total	M	F	Unk	M	F	Unk	Total	% Males
1993–1994												
Fall 1993	0	0	0	0	0	0	0	0	0	0	0	
Spring 1994	0	1	0	1	0	0	0	0	1	0	1	
Total	0	1	0	1	0	0	0	0	1	0	1	0
1994–1995												
Fall 1994	1	0	0	1	0	0	0	1	0	0	1	
Spring 1995	0	0	0	0	0	0	0	0	0	0	0	
Total	1	0	0	1	0	0	0	1	0	0	1	100
1995–1996												
Fall 1995	0	0	0	0	0	0	0	0	0	0	0	
Spring 1996	0	0	0	0	0	0	0	0	0	0	0	
Total	0	0	0	0	0	0	0	0	0	0	0	0
1996–1997												
Fall 1996	2	1	0	3	0	0	0	2	1	0	3	
Spring 1997	0	0	0	0	0	0	0	0	0	0	0	
Total	2	1	0	3	0	0	0	2	1	0	3	67
1997–1998												
Fall 1997	1	0	0	1	0	0	0	1	0	0	1	
Spring 1998	0	1	0	1	0	0	0	0	1	0	1	
Total	1	1	0	2	0	0	0	1	1	0	2	50

[a] Includes illegal kills.

[b] Includes defense of life or property kills, research mortalities, and other known human-caused accidental mortality. These data not included in tables of chronology, transport, etc.

[c] Percentage includes only bears of known sex.

Table 1e Unit 25C grizzly bear harvest, regulatory years 1993–1994 through 1997–1998

Regulatory year	Reported											
	Hunter kill[a]				Nonhunting kill[b]			Total estimated kill[c]				
	M	F	Unk	Total	M	F	Unk	M	F	Unk	Total	% Males
1993–1994												
Fall 1993	3	0	0	3	0	0	0	3	0	0	3	
Spring 1994	0	0	0	0	0	0	0	0	0	0	0	
Total	3	0	0	3	0	0	0	3	0	0	3	100
1994–1995												
Fall 1994	1	0	0	1	0	0	0	1	0	0	1	
Spring 1995	0	0	0	0	0	0	0	0	0	0	0	
Total	1	0	0	1	0	0	0	1	0	0	1	100
1995–1996												
Fall 1995	2	0	0	2	0	0	0	2	0	0	2	
Spring 1996	0	0	0	0	0	0	0	0	0	0	0	
Total	2	0	0	2	0	0	0	2	0	0	2	100
1996–1997												
Fall 1996	1	2	0	3	0	0	0	1	2	0	3	
Spring 1997	0	0	0	0	0	0	0	0	0	0	0	
Total	1	2	0	3	0	0	0	1	2	0	3	33
1997–1998												
Fall 1997	1	0	0	1	0	0	0	1	0	0	1	
Spring 1998	0	0	0	0	0	0	0	0	0	0	0	
Total	1	0	0	1	0	0	0	1	0	0	1	100

[a] Includes illegal kills.

[b] Includes defense of life or property kills, research mortalities, and other known human-caused accidental mortality. These data not included in tables of chronology, transport, etc.

[c] Percentage includes only bears of known sex.

Table 2 Unit 20A, 20B, 20C, 20F, and 25C grizzly bear harvest in 3 zones, calendar years 1991 through 1997

Harvest zone	Area (mi^2)	Calendar year	Bears killed		3-year mean harvest		Harvest density[c]
			All ages[a]	≥2 years[b]	All ages	≥2 years[b]	
Unit 20A mountains	3081[d]	1993	14	14			4.5
		1994	9	9			2.9
		1995	11 (1)	11	11.3	11.3	3.6
		1996	8	7	9.3	9.0	2.3
		1997	10 (1)	10	9.7	9.3	3.2
Eastern half of Unit 20B	4929	1993	2 (1)	2			0.4
		1994	2	2			0.4
		1995	7	5	3.7	3.0	1.0
		1996	10 (1)	10	6.3	5.7	2.0
		1997	3	3	6.7	6.0	0.6
Unit 20A Flats, Western half of Unit 20B, Unit 20C Outside Denali National Park, Units 20F and 25C	26,278[e]	1993	6	6			0.2
		1994	21 (7)	21			0.8
		1995	6	6	11.0	11.0	0.2
		1996	18 (2)	18	15.0	15.0	0.7
		1997	14	14	12.7	12.7	0.5

[a] Parentheses indicate how many of these bears were killed by other than hunter harvest (i.e., defense of life or property, illegal kills, research activities).
[b] Assuming all bears of unknown age were ≥2 years old.
[c] Bears ≥2 years old harvested per 1000 mi^2.
[d] Excludes about 500 mi^2 (1300 km^2) of nonbear habitat in glaciers and above 6000 ft. (1,850 m).
[e] Excludes 4450 mi^2 (11,500 km^2) that is closed to hunting in Denali National Park.

Table 3 Unit 20A, 20B, 20C, 20F, and 25C grizzly bear successful hunter residency, regulatory years 1993–1994 through 1997–1998

Regulatory year	Alaska residents (%)	Nonresident (%)	Unknown (%)	*n*
1993–1994	18[a] (69)	8 (31)	0 (0)	26
1994–1995	19 (69)	4 (14)	5[b] (18)	28
1995–1996	12 (63)	6 (32)	1 (5)	19
1996–1997[c]	24 (63)	10 (26)	4 (11)	38
1997–1998[c]	18 (72)	7 (28)	0 (0)	25

[a] Includes 5 illegal kills.
[b] Includes 1 defense of life or property and 2 vehicle collisions.
[c] Excludes bears killed in defense of life or property or illegally.

Table 4 Unit 20A, 20B, 20C, 20F, and 25C grizzly bear harvest chronology percent by time period, regulatory years 1993–1994 through 1997–1998

Regulatory year	Percent of harvest[a]								
	Sep					May			
	1–15	16–30	Total	Oct	Apr	1–15	16–31	Total	*N*
1993–1994	38	19	57	5	0	5	33	38	21
1994–1995	40	28	68	0	0	8	24	32	25
1995–1996	37	37	74	5	5	16	5	21	19
1996–1997	43	34	77	3	0	9	11	23	35
1997–1998	32	44	76	0	0	4	20	24	25

[a] Excludes bears killed in defense of life or property or illegally.

Table 5 Units 20A, 20B, 20C, 20F, and 25C grizzly bear harvest percent by transport method, regulatory years 1993–1994 through 1997–1998

Regulatory year	Harvest percent by transport method[a]								
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Other/Unk	*n*
1993–1994	19	29	19	10	0	5	19	0	21
1994–1995	8	12	16	20	0	4	24	16	25
1995–1996	21	26	21	21	0	5	5	0	19
1996–1997	29	11	20	20	0	0	14	6	35
1997–1998	20	16	4	36	0	4	8	12	25

[a] Does not include defense of life or property, research mortality, or other human-caused accidental or illegal mortality.

LOCATION

GAME MANAGEMENT UNIT: 20D (5637 mi^2)

GEOGRAPHIC DESCRIPTION: Central Tanana Valley near Delta

BACKGROUND

Brown bears are distributed throughout Unit 20D; however, the Tanana River separates brown bear habitat into 2 distinct types within the unit. Unit 20D south of the Tanana River is adjacent and similar to habitat described by Reynolds (1990) for the foothills and mountains of the northcentral Alaska Range. Brown bear habitat in Unit 20D north of the Tanana River is adjacent and similar to habitat described in Unit 20E by Gasaway et al. (1990) for the hills north of the Tanana River. Hunter access to southern Unit 20D is excellent, while hunter access is more difficult in northern Unit 20D.

MANAGEMENT DIRECTION

The objective for Unit 20D is to manage for an annual harvest of 5–15 bears/year.

METHODS

Successful hunters were required to have brown bears sealed at department offices. Data collected from each brown bear included sex, skull length and width, transportation used by the hunter, number of days hunted, date and location of kill, and hunter name and address. A premolar tooth was extracted from each bear skull for use in age determination. Bears that died from nonhunting mortality sources, such as defense of life or property (DLP) killings, were also sealed. Data were summarized by regulatory year (RY = 1 July–30 June).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

I calculated brown bear population estimates for Unit 20D in May 1993. The Unit 20D estimate was 181–210 total bears, with 143–176 bears ≥ 2 years old. For the population estimate, we calculated separate estimates for Unit 20D north and south of the Tanana River as described below.

Southern Unit 20D. The population estimate for southern Unit 20D was 51–58 brown bears ≥ 2 years old and a total of 76–86 bears. This estimate was based on density estimates of 25.4–29.0 bears ≥ 2 years old/1000 mi^2, plus an additional 14% for cubs and yearlings, developed by Reynolds (1993) for similar habitat in the Alaska Range in Unit 20A.

Anecdotal information for southern Unit 20D from local residents, hunters, and pilots indicate that bears are common in most of the area. Residents commonly report bears near town, the

landfill, and in the Delta Agricultural Project. Dall sheep hunters, moose hunters, and caribou hunters commonly report seeing bears in the foothills of the Alaska Range.

Northern Unit 20D. The population estimate for northern Unit 20D was 92–109 brown bears ≥ 2 years old and 105–124 total bears. This estimate was based on Gasaway's (1990) brown bear density estimates for Unit 20E of 26.9–32.1 bears ≥ 2 years old/1000 mi^2, plus an additional 14% for cubs and yearlings.

Reynolds (personal communication) plans to refine Alaska Range brown bear density estimates upon which we based the population estimate for southern Unit 20D. He also plans to complete a population model that calculates sustainable harvest levels based on harvest of females, rather than the current model that uses total adult harvest as the basis for estimating harvest goals. When this information is available, the Unit 20D population estimate and management objectives should be reviewed and reevaluated.

Population Composition

Brown bear population composition is unknown for Unit 20D. Because cubs or females accompanied by cubs are illegal to harvest, the sex ratio of the harvest was not used to estimate population composition.

Distribution and Movements

Brown bears are distributed throughout Unit 20D; however, no specific information on patterns of brown bear distribution or movements is available.

MORTALITY

Harvest

Season and Bag Limit. During RY 1996–1997 and RY 1997–1998 those portions of Unit 20D south of the Tanana River and east of the east bank of the Gerstle River, or north of the Tanana River, had a 10 August–30 June hunting season for residents and nonresidents. There was also a bag limit of 1 bear/year, and no $25 tag was required of residents. Hunters taking bears in this area were required to have the bears sealed in Unit 20D or in Tok.

The hunting season south of the Tanana River and west of the Gerstle River for residents and nonresidents was 1 September–31 May. The bag limit was 1 bear/4 regulatory years and a $25 tag was required of resident and nonresident hunters.

Board of Game Actions and Emergency Orders.

RY 1996–1997 — At the March 1997 Board of Game meeting, the board considered regulation proposal 163 submitted by the Delta Fish and Game Advisory Committee to reauthorize the tag fee exemption for those portions of Unit 20D north of the Tanana River, and that portion south of the Tanana River and east of the Gerstle River. During the meeting, proposal 163 was amended by the board to change the hunting season dates in the proposal area from 10 August–30 June to 1 September–31 May. The amended proposal passed to

reauthorize the tag fee exemption in portions of Unit 20D, along with the shorter hunting season.

In April 1997 the board reconsidered Proposal 163 based on letters written to the board by the Delta, Fairbanks, and Upper Tanana-Fortymile advisory committees. The committees were concerned that the board had voted on an amended version of Proposal 163 in March, without advisory committees having an opportunity to comment on the amended proposal. Upon reconsideration, the hunting season was returned to its original date of 10 August–30 June.

RY 1997–1998 — During their March 1998 meeting, the board considered 4 brown bear regulation proposals for Unit 20D.

Three of the proposals dealt with tag fees, with 2 proposals requesting reauthorization of brown bear tag fee exemptions in those portions of Unit 20D north of the Tanana River and that portion in Unit 20D south of the Tanana River and east of the Gerstle River. One proposal requested a brown bear tag fee in all of Unit 20D. The tag fee exemption was reauthorized.

The fourth proposal was to restore a bag limit of 1 bear/4 years in all of Unit 20D. The proposal was not passed.

Hunter Harvest.

RY 1996-1997 — Hunters killed 7 bears (Table 1) and met the harvest objective. Hunter take consisted of 71% males. This harvest was an estimated 3–4% of the estimated unitwide brown bear population and 4–5% of the estimated population of bears ≥2 years old.

The number of bears killed by hunters was significantly reduced from the 16 bears killed in RY 1995–1996, and the take was very similar to the previous 5 years during which regulations were more restrictive in portions of Unit 20D. During RY 1990–1991 through 1994–1995, hunters killed a mean of 7 bears/year (r = 5–9) (Table 1).

In southern Unit 20D (south of the Tanana River), hunters killed 4 bears west of the Gerstle River where hunting regulations were more restrictive and 1 bear east of the Gerstle River where regulations were more liberal. Harvest south of the Tanana River represented 6–7% of the total estimated population, and 9–10% of the estimated population of bears ≥2 years old, with most of this harvest coming west of the Gerstle River.

Two bears were killed in northern Unit 20D (north of the Tanana River), where hunting regulations were more restrictive. This harvest was 2% of the total estimated population, and 2% of the estimated population of bears ≥2 years old.

RY 1997–1998 — Hunters killed 8 bears during RY 1997–1998 (Table 1) and met our harvest objective. One of the bears was a nuisance bear killed by a person with a hunting license. Hunters killed 63% male bears.

In southern Unit 20D hunters killed 5 bears; all were taken west of the Gerstle River, including the nuisance bear. No bears were killed east of the Gerstle River. Harvest south of

the Tanana River was 6–7% of the total estimated population and 9–10% of the estimated population of bears ≥2 years old, with all of the harvest coming west of the Gerstle River.

Three bears were killed in northern Unit 20D. This harvest was 2–3% of the total estimated population and 3% of the estimated population of bears ≥2 years old.

Hunter Residency and Success. No significant changes occurred in previous patterns of residency for successful Unit 20D hunters during this reporting period. Most brown bears continued to be killed by residents. During this reporting period, Unit 20D residents took 67% of the harvest, nonlocal residents 27%, and nonresidents 7% (Table 2).

Harvest Chronology. No significant change occurred in previous patterns of harvest chronology during this reporting period. In Unit 20D most brown bears continued to be taken during the fall hunting season. During RY 1996–1997 and 1997–1998, 80% of the bears killed by hunters were taken during August–October (Table 3).

Transport Methods. Most transportation types, except snowmachines, were used to take bears in Unit 20D. Highway vehicles, 3- or 4-wheelers, boats, airplanes, and foot access continued to be commonly used transportation types for brown bears (Table 4).

Other Mortality

During this reporting period, a significant number of brown bears were killed in nonhunting circumstances (5 females). They were taken primarily in southern Unit 20D, west of the Gerstle River and comprised 25% of brown bears known killed in the unit (Table 1).

During RY 1996–1997, 4 bears were killed in nonhunting circumstances (Table 1). All were killed in southern Unit 20D. West of the Gerstle River, 1 bear was taken DLP, 1 was killed illegally, and 1 was hit by a highway vehicle. East of the Gerstle River, 1 bear was killed DLP. Total known mortality was 11 bears and comprised 46% males.

During RY 1997–1998, nonhunting mortality totaled 1 female bear killed DLP west of the Gerstle River (Table 1). Total known mortality was 9 bears and included 56% males.

CONCLUSIONS AND RECOMMENDATIONS

The Board of Game reauthorized brown bear tag fee exemptions in portions of Unit 20D as part of an intensive management program to increase numbers of moose and caribou. The harvest objective of 5–15 bears/year was met in both RY 1996–1997 and RY 1997–1998, with hunters taking predominantly male bears.

Total brown bear mortality in Unit 20D increased from both hunting and nonhunting sources and averaged 10 bears/year during this reporting period. An annual mortality of 10 bears/year was the estimated sustainable harvest, based on a sustainable harvest rate of 6% of the population/year.

In northern Unit 20D, total brown bear mortality averaged 1 bear/year in the 5 years before the hunting season, bag limit, and tag fee were liberalized in RY 1992–1993 (Table 5). Since RY 1992–1993 when the season was lengthened to 10 August–30 June, the bag limit was increased to 1 bear/year, and the tag fee was eliminated, total mortality has increased to 3 bears/year. I estimate this mortality is below the sustainable harvest level in northern Unit 20D, and the liberalized regulations have not reduced the brown bear population or ungulate predation from brown bears, as intended with intensive management.

In southern Unit 20D, total brown bear mortality averaged 6 bears/year in the 8 years before the hunting season, bag limit, and tag fee were liberalized east of the Gerstle River in RY 1995–1996 (Table 5). Since RY 1995–1996 when the season was lengthened to 10 August–30 June, the bag limit was decreased to 1 bear/year, and the tag fee was eliminated east of the Gerstle River, the mortality has increased to 7 bears/year. However, the increased mortality in southern Unit 20D has occurred west of the Gerstle River with more conservative regulations, rather than east of the Gerstle River where liberalized regulations were adopted for intensive management of the Macomb caribou herd.

Based on my population estimates, brown bear mortality may be at or near sustainable levels east of the Gerstle River but exceeding sustainable levels west of the Gerstle River. A significant portion of the brown bear mortality west of the Gerstle River is due to nonhunting mortality that results from people living near brown bears.

Although I estimated the brown bear population west of the Gerstle River may be experiencing mortality higher than sustainable, anecdotal observations indicate that bears are plentiful in the area. This is an area that will continue to experience high levels of bear mortality because of the number of people that live throughout it. However, because this area is relatively small and surrounded by areas that have healthy brown bear populations, no reduction in the hunting regulations are planned at this time. There is significant demand for human use of moose and caribou in southern Unit 20D, and current population objectives are to increase the size of these ungulate populations. A localized reduction in the brown bear population may benefit survival of moose and caribou calves.

The Unit 20D brown bear population should be monitored closely during the next few years to determine long-term effects of liberalized hunting regulations in portions of the unit and to monitor the population west of the Gerstle River where mortality rates are highest.

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PREPARED BY:

Stephen D DuBois
Wildlife Biologist III

SUBMITTED BY:

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Harry V Reynolds, III
Wildlife Biologist III

Table 1 Unit 20D brown bear harvest[a], regulatory years 1989–1990 through 1997–1998

Regulatory year	Reported							Estimated kill		Total reported and estimated kill			
	Hunter kill				Nonhunting kill[a]								
	M	F	Unk	Total	M	F	Unk	Unreported	Illegal	M	F	Unk	Total
1989–1990													
Fall 1989	2	0	0	2	0	0	0	1	0	2	0	1	3
Spring 1990	2	0	0	2	0	0	0	0	0	2	0	0	2
Total	4	0	0	4	0	0	0	1	0	4	0	1	5
1990–1991													
Fall 1990	3	2	0	5	0	0	0	1	0	3	2	1	6
Spring 1991	0	2	0	2	0	0	0	0	0	0	2	0	2
Total	3	4	0	7	0	0	0	1	0	3	4	1	8
1991–1992													
Fall 1991	0	0	0	0	0	1	0	1	0	0	1	1	2
Spring 1992	2	3	0	5	0	0	0	0	0	2	3	0	5
Total	2	3	0	5	0	1	0	1	0	2	4	1	7
1992–1993													
Fall 1992	4	2	0	6	1	0	0	1	0	5	2	1	8
Spring 1993	2	1	0	3	0	0	0	0	0	2	1	0	3
Total	6	3	0	9	1	0	0	1	0	7	3	1	11
1993–1994													
Fall 1993	5	1	0	6	0	0	0	1	0	5	1	1	7
Spring 1994	0	1	0	1	0	0	0	0	0	0	1	0	1
Total	5	2	0	7	0	0	0	1	0	5	2	1	8
1994–1995													
Fall 1994	2	2	0	4	0	0	0	1	0	2	2	1	5
Spring 1995	1	1	0	2	1	0	0	0	0	2	1	0	3
Total	3	3	0	6	1	0	0	0	0	4	3	1	8
1995–1996													
Fall 1995	8	3	0	11	0	0	0	1	0	8	3	1	12
Spring 1996	3	2	0	5	0	0	0	0	0	3	2	0	5
Total	11	5	0	16	0	0	0	1	0	11	5	1	17
1996–1997													

Table 1 Continued

Regulatory year	Reported							Estimated kill		Total reported and estimated kill			
	Hunter kill				Nonhunting kill[a]								
	M	F	Unk	Total	M	F	Unk	Unreported	Illegal	M	F	Unk	Total
Fall 1996	4	2	0	6	0	3	0	1	0	4	5	1	10
Spring 1997	1	0	0	1	0	1	0	0	0	1	1	0	2
Total	5	2	0	7	0	4	0	1	0	5	6	1	12
1997–1998													
Fall 1997	3	3	0	6	0	0	0	1	0	3	3	1	7
Spring 1998	2	0	0	2	0	1	0	0	0	2	1	0	3
Total	5	3	0	8	0	1	0	1	0	5	4	1	10

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

Table 2 Unit 20D brown bear successful hunter residency, regulatory years 1989–1990 through 1997–1998

Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total successful hunters
1989–1990	3	1	0	0	4
1990–1991	4	2	0	1	7
1991–1992	3	0	0	0	3
1992–1993	6	4	0	0	10
1993–1994	3	4	0	0	7
1994–1995	2	4	0	0	6
1995–1996	7	6	1	2	16
1996–1997	5	2	0	0	7
1997–1998	5	2	1	0	8

[a] Residents of Unit 20D.

Table 3 Unit 20D brown bear harvest chronology by month, regulatory years 1989–1990 through 1997–1998

Regulatory year	Harvest periods								
	Aug	Sep	Oct	Nov	Apr	May	Jun	Other	*n*
1989–1990	0	2	0	0	0	2	0	0	4
1990–1991	0	5	0	0	0	2	0	0	7
1991–1992	0	1	0	0	0	4	1	0	6
1992–1993	0	4	2	0	0	3	0	1	10
1993–1994	1	4	0	1	0	1	0	0	7
1994–1995	0	4	0	0	0	2	0	0	6
1995–1996	1	9	1	0	0	2	3	0	16
1996–1997	1	4	1	0	0	1	0	0	7
1997–1998	0	5	1	0	0	2	0	0	8

Table 4 Unit 20D brown bear harvest percent by transport method, regulatory years 1989–1990 through 1997–1998

Regulatory year	Percent by transport method										
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Foot	Other	Unk	*n*
1989–1990	0	0	25	0	0	25	25	25		0	4
1990–1991	0	14	0	0	0	57	14	14		0	7
1991–1992	0	0	0	0	17	17	0	67		0	6
1992–1993	10	10	20	20	0	0	30	10		0	10
1993–1994	14	0	29	0	0	0	43	14		0	7
1994–1995	17	17	0	33	0	0	17	17		0	6
1995–1996	25	0	13	25	0	0	31	6		0	16
1996–1997	0	0	29	14	0	14	43	0		0	7
1997–1998	13	0	13	25	0	13	13	0	25	0	8

Table 5 Unit 20D brown bear harvest[a] with differing hunting regulations, regulatory years 1987–1988 through 1997–1998

Regulatory year	Southern Unit 20D: West of Gerstle River M	F	East of Gerstle River M	F	Unk location M	F	Total M	F	Northern Unit 20D M	F	Total Unit 20D M	F	Total bears M+F
	1 bear/4 yr, 1 Sep–31 May, $25 tag[b]												
1987–1988	2	0	4	4	1	0	7	4	0	1	7	5	12
1988–1989	1	1	1	1	0	0	2	2	2	0	4	2	6
1989–1990	2	0	0	0	0	0	2	0	2	0	4	0	4
1990–1991	1	2	2	0	0	1	3	3	0	1	3	4	7
1991–1992	2	3	0	1	0	0	2	4	0	0	2	4	6
Total kill	8	6	7	6	1	1	16	13	4	2	20	15	35
Kill/Year	3		3		0		6		1		7		
% Male	57		54		50		55		67		57		
	1 bear/4 yr, 1 Sep–31 May, $25 tag								1 bear/yr, 10 Aug–30 Jun, no tag fee				
1992–1993	4	1	1	1	0	1	5	3	2	0	7	3	10
1993–1994	2	0	2	1	0	0	4	1	1	1	5	2	7
1994–1995	3	2	1	1	0	0	4	3	0	0	4	3	7
Total kill	9	3	4	3	0	1	13	7	3	1	16	8	24
Kill/Year	4		2		0		7		1		8		
% Male	75		57		0		65		67		67		
	1 bear/4 yr, 1 Sep–31 May, $25 tag		1 bear/yr, 10 Aug–30 Jun, no tag fee						1 bear/yr, 10 Aug–30 Jun, no tag fee				
1995–1996	4	1	3	1	0	0	7	2	4	3	11	5	16
1996–1997	3	4	1	1	0	0	4	5	1	1	5	6	11
1997–1998	3	3	0	0	0	0	3	3	2	1	5	4	9
Total kill	10	8	4	2	0	0	14	10	7	5	21	15	36
Kill/Year	5		2		0		7		3		10		
% Male	56		67		0		58		58		58		

[a] Includes nonhunting mortality.
[b] Hunting regulation.

LOCATION

GAME MANAGEMENT UNIT: 20E (11,000 mi^2)

GEOGRAPHIC DESCRIPTION: Fortymile, Charley, and Ladue River drainages, including the Tanana Uplands and all drainages into the south bank of the Yukon River upstream from and including the Charley River drainage

BACKGROUND

The grizzly bear population in Unit 20E declined to low levels during the 1950s as a result of an intensive, year-round federal predator control program. After the program ended, bears were lightly exploited throughout the 1960s and 1970s. While no studies specifically addressed this question in Unit 20E, it is reasonable to assume that the population recovered to 21 bears/1000 km^2 based on estimated grizzly bear densities in areas with comparable habitats (Reynolds 1997). There are no salmon spawning streams in Unit 20E and the natural density of bears is comparatively lower than areas with salmon.

During the early 1980s moose densities in Unit 20E were low (0.2 moose/mi^2, 0.5 moose/km^2) and grizzly bears were a major factor in limiting this population (Gasaway et al. 1992). In an attempt to reduce the grizzly bear population, hunting regulations were liberalized. Our objective was to reduce the grizzly population through increased harvest to a level that allowed a substantial decline in bear predation on calf moose. Regulation changes included: lengthening the season; increasing the bag limit from 1 bear/4 years to 1 bear/year; and between 1984 and 1992, revoking the $25 resident tag fee requirement. Mean annual grizzly bear harvests increased from 3 during regulatory years (RY = 1 July–30 June) 1966–1981 to 19 during regulatory years 1982–1988. Based on the combination of harvest rate, harvest sex ratio, skull size, and average age of the harvested bears, it is reasonable to assume that harvest resulted in reduction in the grizzly bear population in a portion of Unit 20E. Further support for this contention is that the Unit 20E grizzly bear population was estimated at 31–41 bears/1000 mi^2 (12–16 bears/1000 km^2; Boertje et al. 1987) by the mid-1980s.

Survival of moose calves to 5 months of age in Unit 20E increased between 1982 and 1990, during the period of liberalized bear seasons. We believed this increased calf survival was related to a reduction in the number of predators per prey animal because moose numbers slowly increased in areas where bear numbers were decreasing. This interpretation has led to adoption of liberalized grizzly bear harvest regulations in other areas even though there have often been no field studies designed to evaluate the effects of bear population reductions on moose and caribou calf survival (Alaska Department of Fish and Game 1996, 1998).

MANAGEMENT DIRECTION

MANAGEMENT GOAL

- Provide maximum opportunity to participate in hunting grizzly bears in Unit 20E.

MANAGEMENT OBJECTIVES

- Manage to effect temporary reductions in the grizzly bear population or to reduce the extent of bear predation where it is limiting moose population growth (e.g., moose populations are below food-limiting densities with fall calf:cow ratios <25:100).

- After moose populations increase to desired levels, reduce bear harvests to stop declines and/or allow for bear population recovery.

When developing grizzly bear and wolf management goals in a multi-prey, multi-predator system, the management goals and objectives of the area's moose and caribou populations should also be considered. In Unit 20E, the Fortymile caribou herd management objectives were designed to promote recovery of the Fortymile caribou herd. Currently there are few viable management methods practically available that would result in an increase in the unit's moose population, but the majority of local residents desire a higher moose population. Area moose populations are currently limited by predation and grizzly bears are the primary predator on newborn moose calves (Gasaway et al. 1992). For this reason, since 1981 we have been conducting a management experiment to evaluate the effectiveness of reductions of grizzly bear populations in order to increase moose calf survival.

METHODS

Grizzly bears harvested in Unit 20E must be sealed in the subunit or in Tok before being transported out of the area. During the sealing process, we determine the sex of the bear, measure the length and width of the skull, extract a premolar tooth, and collect information on date and location of harvest and time spent afield by the hunter. Premolar teeth were sent to Matson's Laboratory (Milltown, Montana USA) for aging. Harvest data were summarized by regulatory year.

I evaluated the trend of the Unit 20E bear populations in the treatment area by comparing the kill density (number of bears harvested/10,000 km^2) (Miller 1990) and male skull size for RY 1977–1978 through 1981–1982 to that for RY 1982–1983 through 1997–1998. I made the comparison by using a *t*-test and the Satterthwaite correction and by calculating regressions of sex ratio, skull size, and age by sex of the harvested bears over time. Using linear regression, I evaluated the effects of increased grizzly bear harvest on moose calf survival. I compared moose cow:calf ratios in the treated areas (high bear harvest) with control areas (low/moderate bear harvest) before and during years of high bear harvest.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

I estimated that the fall 1998 Unit 20E population was 475–550 bears (17.1–19.8 bears of all ages/1000 km^2, 44.3–51.3/1000 mi^2) and that the population trend was relatively stable. My estimate was based on radiotelemetry data collected by Boertje et al. (1987), Unit 20E harvest statistics collected since 1977, and bear harvest and population trend data collected from an

intensively hunted grizzly bear population in the central Alaska Range (Reynolds and Boudreau 1992).

Reynolds and Boudreau (1992) found that ≥6% mortality rate of adult females ≥6 years old would result in a grizzly bear population decline. In addition, Reynolds (1990) reported that an overall harvest of 11% for 8 years resulted in a population decline of 32%. Natural mortality accounted for about 2% annually and human-caused mortality included hunter kills, illegal kills, and wounding losses.

Grizzly bear hunting regulations in Unit 20E were liberalized in 1982 with the intent of reducing the bear population. Since 1982, annual harvests were below sustainable levels in Unit 20E as a whole. However during the 1980s and early 1990s, in that portion of Unit 20E that includes the Dennison, Middle, West, and Mosquito Forks of the Fortymile River and the upper Charley River drainages (encompassed 3670 mi^2; 9500 km^2), harvest rate was 6–9% of the population, including harvest rates of 8–20% of the female bears >5 years old. This area of high harvest will be referred to as the treated area.

Using Reynolds and Boudreau (1992) sustainable mortality rates for females and all bears, I estimated that grizzly bear numbers in the treated area declined by 2% annually between 1982 and 1988. The population was probably stable during 1989 through 1991 but declined by 2% annually between 1992 and 1996, again due to high harvest rates (harvest density = 8.3/10,000 mi^2; 3.2/10,000 km^2). In the remainder of Unit 20E (about 7000 mi^2; 18,000 km^2), harvest remained low (harvest density = 0.44/10,000 mi^2 or 0.17/10,000 km^2) and had little effect on population trend. For comparison, I designated this area of low harvest as the control area (Table 1).

Taken independently, specific harvest statistics indicate some initial effect on the Unit 20E bear population due to increased harvest. Kill rate data and relationship of percent males in the harvest to age class (Fraser et al. 1982) indicated that the bear population in the treated area was heavily harvested following the change in regulations ($t = 0.001$). Average male skull size during the period of increased harvest was significantly smaller compared to the 5 regulatory years before the increase ($t = 0.0003$; Table 2), and the trend was for increased presence of younger males ($P = 0.059$). These trends indicate that enough large males were harvested to allow for increased immigration of young males. In contrast, skull size and age of harvested females did not change between the 2 periods. It is unlikely that increased presence of young males in the harvest was due to increases in recruitment of young males because there was no evidence of increased recruitment of young females. These data indicate that liberalizing harvest regulations and initiating a public awareness campaign can cause the population to decline, primarily by reducing the number of resident males and by changing the composition to a population more dominated by young males.

Harvest statistics remained consistent throughout the 16 regulatory years of liberal harvest regulations within the treated area and were not significantly different between the treated and control areas. During this time period within the treated area, average age and skull size of harvested males showed a slight decreasing trend but were not significant ($P = 0.520$ and $P = 0.772$, respectively; Figs 1 and 2). Average age and skull of harvested females also

showed declining trends but were not significant ($P = 0.977$, $P = 0.147$, respectively; Figs 3 and 4). The trend of percentage of males in the harvest increased slightly but was not significant ($P = 0.540$; Fig 5). There were no differences between the treated and the control areas for male skull sizes ($P = 0.294$), male age ($P = 0.424$), female skull size ($P = 0.291$), and female age ($P = 0.496$). However, harvest data can give false impressions of the actual population composition because the taking of females with cubs is illegal and there are differences in the vulnerability to harvest by sex and age group. Subadult males are the most vulnerable to harvest. I expect the population composition in the treated area was more skewed toward subadult males than in the control area, but the difference was not detected through harvest records due to the vulnerability of subadults to harvest.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 20E, 1 bear every regulatory year	10 Aug–30 Jun (General hunt only)	10 Aug–30 Jun

A bear taken in this unit did not count against the bag limit of 1 bear every 4 years in other units; however, no person could take more than 1 bear, statewide, per regulatory year. During the report period a $25 resident tag fee was required to hunt grizzly bears in Unit 20E.

Board of Game Actions and Emergency Orders. No regulatory changes for grizzly bears in Unit 20E occurred during the report period. The Board of Game decided against a resident tag fee exemption in Unit 20E and against reducing the bag limit to 1 bear every 4 regulatory years. Since 1996 the board has waived the grizzly bear tag fee in northern Unit 20D in an attempt to increase harvest; this action may affect the grizzly bear population in adjacent portions of Unit 20E.

Hunter Harvest. During RY 1996–1997, hunters reported taking 22 grizzly bears; 11 were taken in RY 1997–1998 (Table 3). The 5-year average harvest was 17 bears. Grizzly bear harvests significantly increased in RY 1982–1983 ($P = 0.001$) compared with harvest totals during RY 1977–1978 through 1981–1982. Harvests remained high until RY 1988–1989 (average annual harvest = 18.9) in response to the more liberal seasons and bag limits. Harvests declined between RY 1989–1990 and 1992–1993 (average harvest = 12.0) even though hunting regulations remained liberal and hunting pressure increased indicating the number of legal bears in the more accessible areas of Unit 20E were reduced or less vulnerable to harvest. The increase in harvest between RY 1993–1994 and RY 1997–1998 can be explained by greater hunter effort in areas that historically received little hunting pressure and supported a higher density of bears. During RY 1996–1997 and 1997–1998 males

represented 48% and 64% of the harvest, respectively. The mean percentage of males taken in the harvest during the past 5 years in Unit 20E was 55%.

Hunter Residency and Success. During the report period, resident hunters took 88% (30/34) of the grizzly bear harvest from Unit 20E, compared with the 5-year average of 77% (Table 4). Historically, little guided hunting for grizzly bears occurred in Unit 20E. The few bears taken by nonresidents were killed while hunting moose or caribou with a first degree kindred relative who was a state resident. Beginning in 1995 several Unit 20E guides began taking more nonresident grizzly bear hunters to remote areas of the subunit.

Harvest Chronology. During the past 10 years, most grizzly bears were harvested incidentally during August and September (76%) when most moose and caribou hunters were afield (Table 5). Most bears taken in spring were taken purposefully and most were taken in May and June.

Transport Methods. During the report period, airplanes were used by 44% of successful grizzly bear hunters in Unit 20E (Table 6). During the previous 5 years, airplanes (39%), 3- or 4-wheelers (22%), and highway vehicles/walk (12%) were the modes of transportation used by most successful bear hunters. Use of airplanes to hunt grizzly bears in Unit 20E is increasing as more hunters are gaining access to remote areas.

Other Mortality

No bears were reported taken in defense of life and property (DLP) incidents during this report period. Possible reasons for the lack of reported DLP kills in recent years were the long season (only closed during 1 Jul–9 Aug) and significantly reduced bear numbers in accessible areas of the unit. Most natural grizzly bear mortality in Unit 20E is probably the result of intraspecific strife and cannibalism (Boertje et al. 1987). Reynolds (1997) estimated natural mortality at 2.5% for females ≥2 years of age during 1981–1992 and 1.9% for females ≥6 years of age during 1993–1996.

HABITAT

Assessment

All of Unit 20E is suitable grizzly bear habitat. Few human developments exist with the exception of the small communities of Eagle, Boundary, and Chicken, and the Taylor Highway. The subunit offers a variety of forbs and berries for grizzly bears; however, there are no arctic ground squirrels and few opportunities for salmon, food types known to be important in other areas. Habitat diversity has also been affected by the abnormally high level of wildfire suppression during the 1960s and 1970s. Habitat usage by grizzly bears is continuous in the subunit and average home range sizes for adult male and female bears are 1409 km^2 (544 mi^2, s = 695) and 391 km^2 (151 mi^2, s = 318.3), respectively (Boertje et al. 1987).

Enhancement

The Alaska Interagency Fire Management Plan: Fortymile Area was implemented in the early 1980s and dictates that over 60% of the area will receive only limited action fire suppression. This means that fires occurring in this area will only receive monitoring and not suppression action, except under exceptionally severe fire conditions. Recurring wildfires increase habitat heterogeneity and productivity for bears and their primary prey. We also have a prescribed fire burn plan for Unit 20E. During July 1998, 58,000 acres of spruce forest burned in eastern Unit 20E. This area was covered by climax spruce forest. Based on range recovery in adjacent burns, grizzly bears will likely benefit from this fire within 10–15 years. We plan to conduct 2 prescribe burns in central Unit 20E during summer 1999.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Research in Unit 20E and other parts of Alaska demonstrated that grizzly bear and wolf predation can be the primary limiting factor in moose and caribou population growth (Gasaway et al. 1992). In Unit 13 a similar pattern was documented (Ballard and Miller 1990). There a grizzly bear translocation study initially indicated that reducing a grizzly bear population by at least 60% would cause a significant increase in moose calf survival (Ballard and Miller 1990); however, further analysis found no evidence that bear reduction contributed to the moose population increase (Miller and Ballard 1992). In an attempt to mimic the results of the bear translocation work, grizzly bear harvest regulations were liberalized in Unit 20E in 1981 with the intent of causing a decrease in the bear population to benefit moose. Results of the more liberal harvest regulations led to a reduction in the bear population and a change in the sex and age composition in a portion of Unit 20E. Initial analyses demonstrated that survival of neonatal moose increased substantially after 8 years of increased grizzly bear harvest and an estimated 2% annual decline in the bear population (Gasaway et al. 1992). Based on the results in Unit 20E, changes in regulation designed to increase hunter harvest of grizzly bears has become a common management technique because of the belief bear population reductions will result in increases in moose calf survival.

Currently within the state there are 4 areas (Units 13, 19D, 20D, and 20E) that have grizzly bear management objectives designed to result in a reduction of the bear population using harvest in order to enhance ungulate calf survival. The Board of Game and all of the advisory committees within the areas fully endorse these programs. However, there is still no scientific basis to determine what level of bear reduction is necessary in relation to ungulate density, wolf density, and other environmental factors to allow for greater calf survival. Furthermore, it may be very difficult to obtain a high level of harvest especially considering hunters are restricted from shooting females accompanied by cubs and bears <2 years old.

In an attempt to gain better insight on the benefits of this management technique in Unit 20E, I reanalyzed harvest and survey data from Unit 20E. I compared calf survival in the treatment area with survival in an adjacent area which received little bear harvest but supported comparable wolf densities (Gardner 1995). The analysis showed there was no difference in calf survival between the treatment area and the control area. I hypothesized that the reduction in bears did not result in an increase in moose calf survival for several possible reasons, including the potential of increased predation rates by bears, habitat differences between the

treated and control areas, and adverse weather conditions. Subsequent predator-prey analysis in an area of similar habitat and predator-prey conditions indicated that wolf predation on moose calves could compensate for any reduction in bear predation (Hayes 1995). If this is true then calf survival improvement would require bear population reductions that coincide with wolf population reduction. Accomplishing further reductions in the bear population size may require allowing the take of females accompanied by cubs.

I hypothesized that environmental factors may also mask the effects of a reduced bear population on moose calf survival. During the 1980s, environmental conditions were favorable to ungulate populations across Interior Alaska. Moose and caribou populations increased in Unit 20E during this period. If environmental conditions were favorable enough so that moose calves were less vulnerable to bear predation, then effects of a reduced bear population may not have been detectable when compared to an area with a density of bears that had not been reduced through hunting. Between 1990 and 1995, environmental conditions appeared to be unfavorable and the moose and caribou populations in Unit 20E remained stable or declined.

I hypothesized that the effects of a reduced bear population would be easier to detect during a period when moose were nutritionally stressed. I compared moose calf survival within the treated area during the 1980s to the 1990s, between the treated area 1990–1997 to the control area 1990–1997, and between the period 1982–1989 to 1990–1997 treated and control areas combined. There were no significant differences between periods within the treated area ($P = 0.143$), between the treatment and control areas 1990–1997 ($P = 0.951$; Fig 6), but there was a significant increase in calf survival between the periods when the treated and control areas were combined ($P = 0.042$). These analyses indicate that the level of bear reduction due to increased harvest was not adequate to cause an increase in moose calf survival but was high enough to effect the composition of the bear population. Because of limited access, hunter interest, bear behavior, change in bear population composition, and regulatory protection of sows with cubs and bears <2 years old, I believe that harvest of bears will not increase enough to result in a decline so that moose calf survival can improve substantially.

In the last 2 grizzly bear reports, I recommended that a research program be initiated to determine under what conditions would increased grizzly bear harvest enhance moose or caribou calf survival. This research would be useful to answer management concerns, but funding is not presently available.

A different bear harvest strategy for both Units 20E and 12 should be designed to allow for maximum grizzly bear hunting opportunity, local population declines when necessary, and adequate protection to the bear population. Regulatory changes that might be considered to accomplish localized reductions included: 1 bear per year bag limit; bear tag exemption; purchase of a tag after harvest; taking of females accompanied by cubs; and/or permits for taking grizzly bears over bait. To ensure that high harvest of the bear population does not jeopardize its later recovery, more restrictive sealing requirements should be implemented by reducing the period between harvest and when the bear has to be sealed. Also, there should be a quota on the number of females in the harvest. This approach would require estimates of the sustained yield for females; a decision about whether the harvest and female quotas should be

based on an average over multiple years, and a determination if the unit or subunit can be further divided to ensure the protection of isolated areas. Answers to these questions should be based on research findings of sustainable yield of grizzly bears in Unit 20A.

CONCLUSIONS AND RECOMMENDATIONS

During fall 1998 I estimated that there were 475–550 grizzly bears in Unit 20E. Harvest data indicated the population has declined only slightly since 1981 amid very liberal hunting regulations. Harvest had little impact on the total population size due to the inaccessibility of most of the subunit. However, in the central portion of the subunit, harvest increased significantly in RY 1982–1983 and remained high until RY 1989–1990. Harvest was also high between RY 1993–1994 and 1996–1997. Annual kill densities were 1.92–4.35 bears/10,000 mi^2 (0.74–1.68/10,000 km^2), the source of an estimated 26% population decline in the central portion of the subunit and a change in the population sex and age composition. Since 1994, harvest has become more dispersed across the subunit. Currently population trend is relatively stable.

Grizzly bear management in Unit 20E provides maximum bear hunting opportunity. However, it does not appear that we met our management objective to cause increased moose or caribou calf survival by reducing the grizzly bear population using liberalized harvest regulations. Calf survival was not different in an area where hunters had reduced the grizzly population compared to an area where the grizzly bear population was at natural densities.

Even though data do not indicate that harvest-caused reductions in bear populations have resulted in enhanced calf survival in the treatment area, I recommend the current management objectives be retained. During the past 2 years trappers and nonlethal wolf control activities have reduced the wolf population in a portion of the subunit. Research and management efforts in conjunction with the Fortymile Caribou Management Plan will benefit from documenting the effects of increased bear harvest in the same area in which wolves have been reduced. If the wolf reduction program is initiated, we will be conducting caribou calf mortality studies between 1997 and 2001 and, hopefully, be able to determine the effects of both reduced wolf and bear populations on calf survival.

Depending on the availability and validation of sustainable harvest models from the Unit 20A grizzly bear research, I may recommend changes in the grizzly bear harvest management objectives in Units 20E and 12 that are based on total harvest and the number of females taken. These changes will require the hunter to be more selective while hunting grizzly bears but, if successful, could ensure the high levels of hunter opportunity while providing adequate protection of the grizzly bear population.

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Craig L Gardner
Wildlife Biologist III

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Harry V Reynolds, III
Wildlife Biologist III

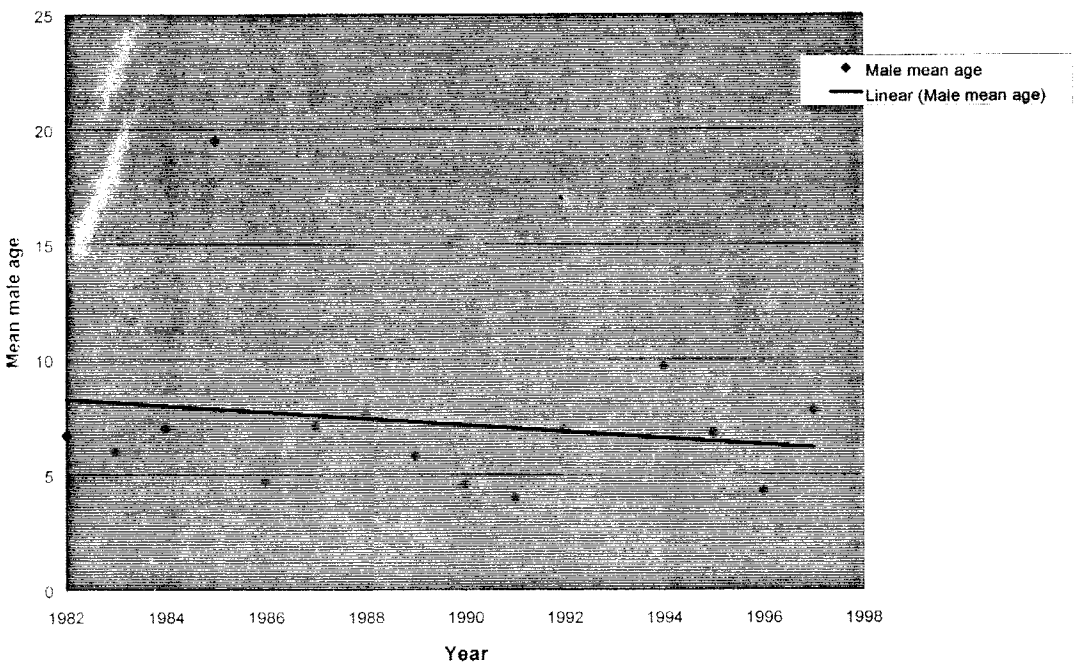

Figure 1 Unit 20E trend of the mean age of male grizzly bears harvested in the treatment area, 1982–1997

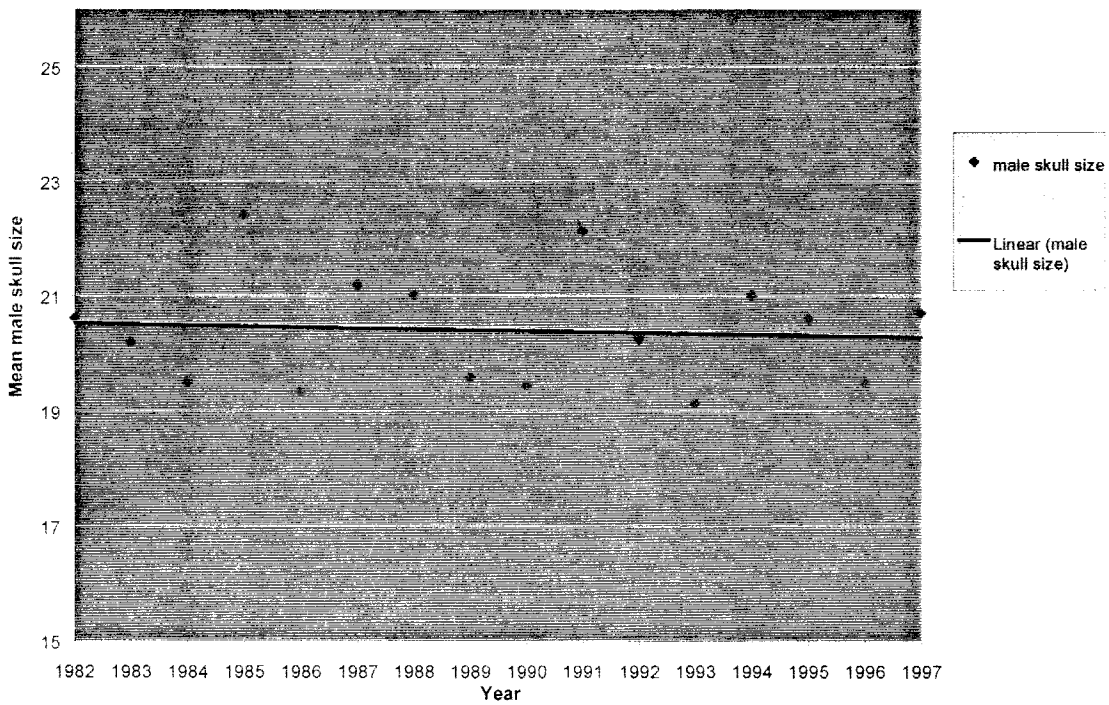

Figure 2 Unit 20E trend of the mean skull size of male grizzly bears harvested in the treatment area, 1982–1997

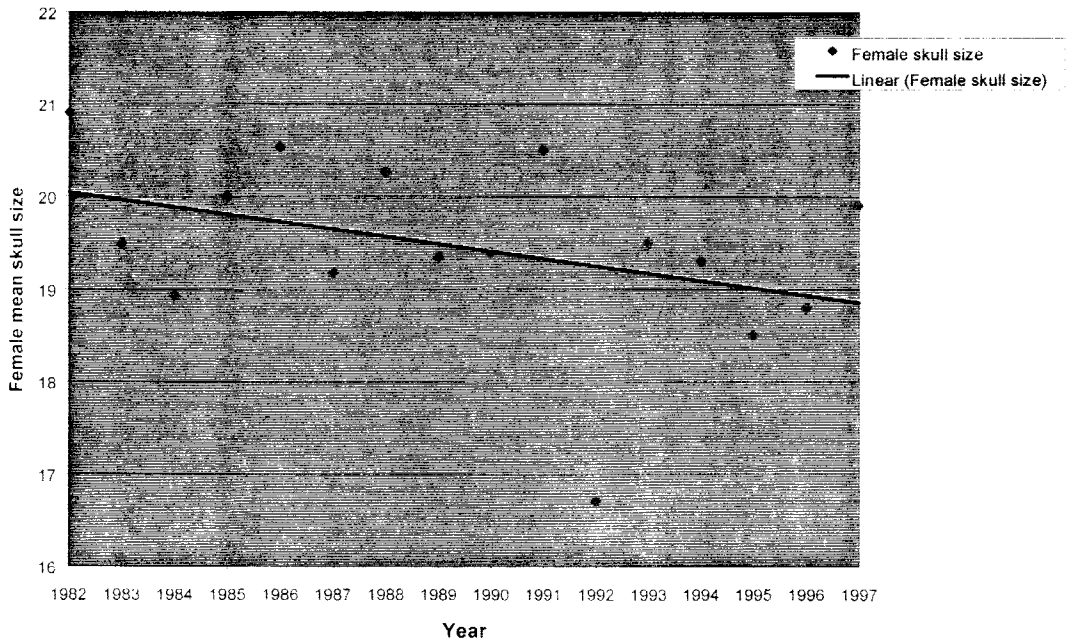

Figure 3 Unit 20E trend of the mean age of female grizzly bears harvested in the treatment area, 1982–1997

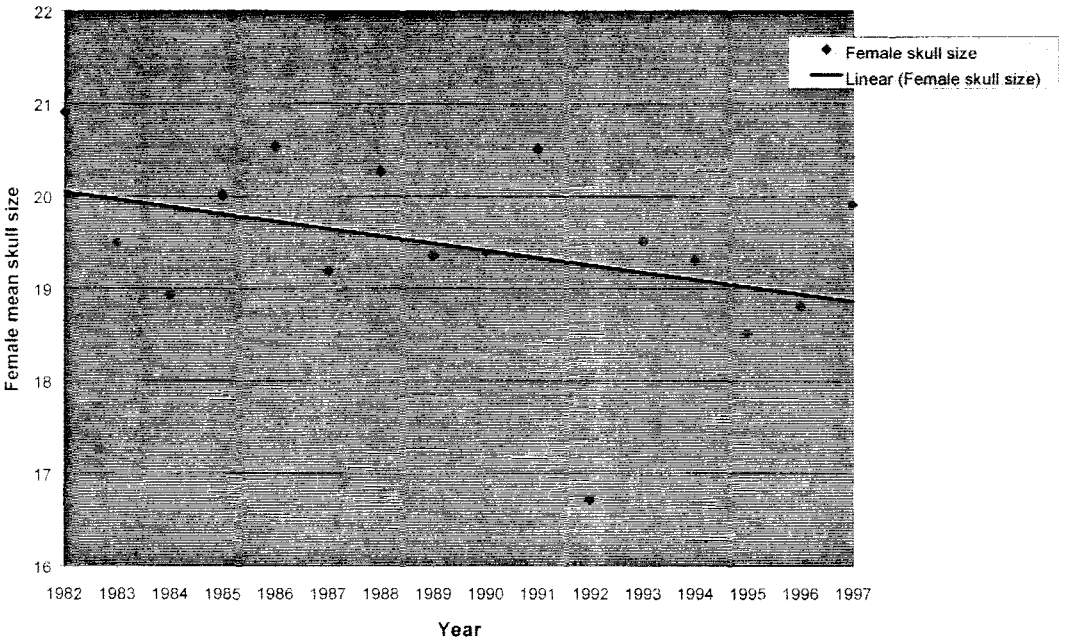

Figure 4 Unit 20E trend of the mean skull size of female grizzly bears harvested in the treatment area, 1982–1997

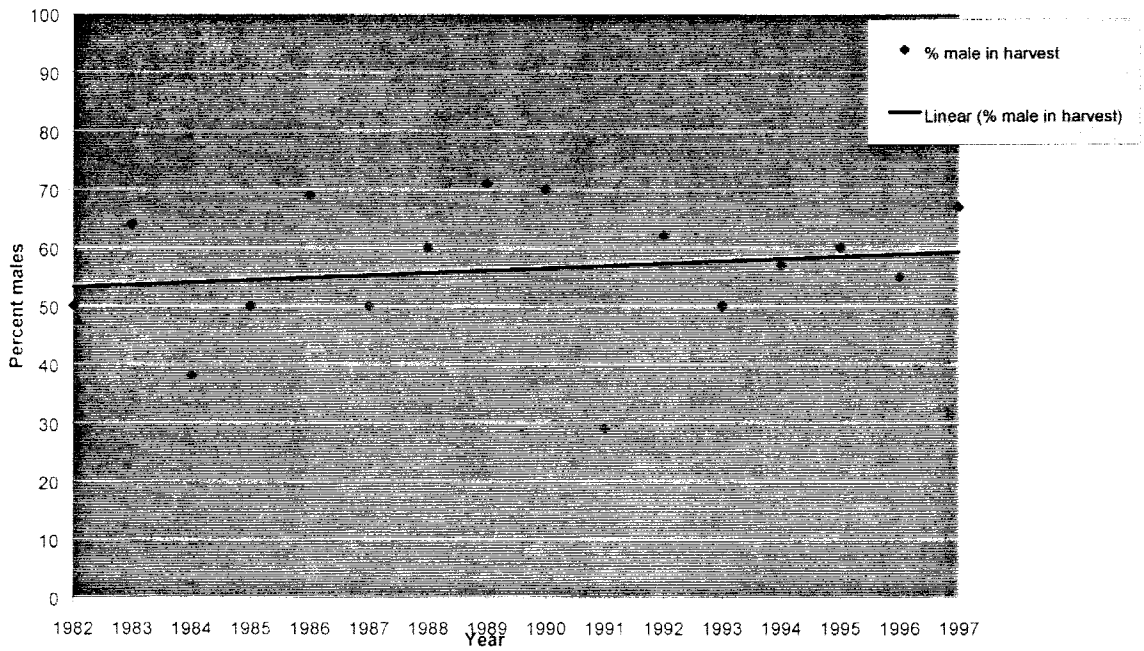

Figure 5 Unit 20E trend of the percentage of male grizzly bears harvested in the treatment area, 1982–1997

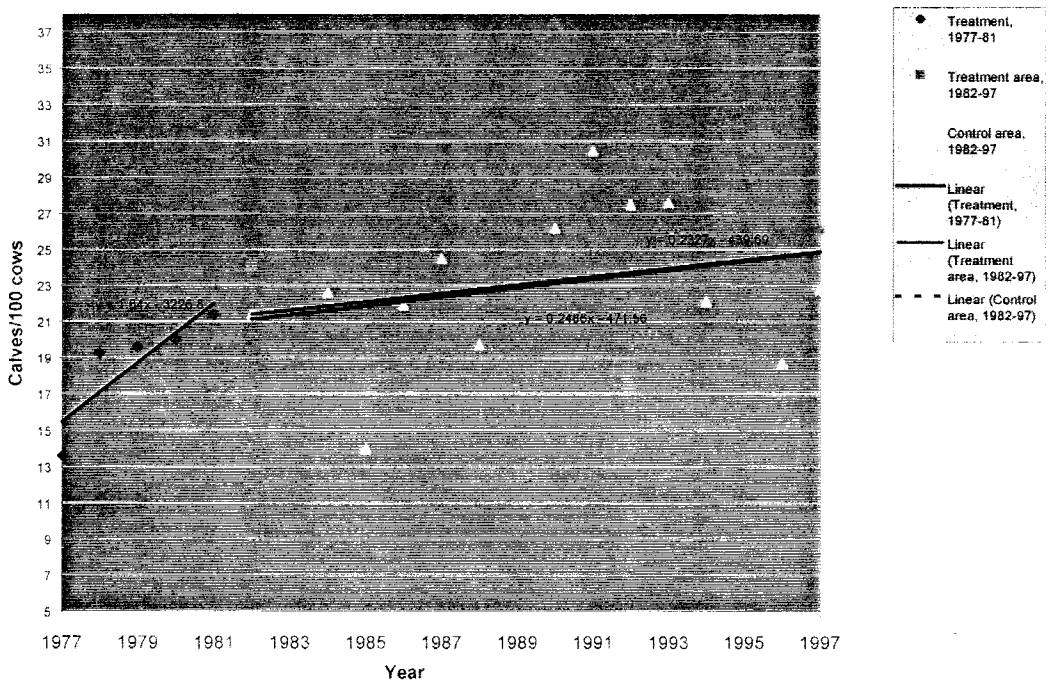

Figure 6 Unit 20E moose calf production in treatment and control areas in Unit 20E, 1977–1997

Table 1 Unit 20E harvest data used in the analyses comparing pretreatment, treatment, and control areas, 1977–1997

	Reported	Male grizzly bears					Female grizzly bears				Moose		
	bear		Skull size				Skull size				Calves/	Calves/	Harvest
Year	harvest	%	$\bar{x}$	n	Age	n	$\bar{x}$	n	Age	n	100	hr	type[a]
1977	4	50	21.90	2		1	19.32	2	6.5	2	6.6	0.99	P
1978	4	50	22.25	2		1	19.56	2	6.0	2	13.6	1.21	P
1979	5	80	24.79	4	13.7	3		1		1	19.2	3.33	P
1980	5	60	23.14	3	11.0	3	17.14	2	2.0	2	19.6	1.17	P
1981	6	100	21.77	4	9.2	5		0		0	20.0		P
1982	14	50	20.61	7	6.7	7	20.90	7	10.3	7	24.1	3.51	T
1982	1	100		1		1		0		0	21.4	1.45	C
1983	14	64	20.20	8	6.0	9	19.49	5	5.5	4			T
1983	1	100		1		1		0		0			C
1984	16	38	19.50	6	7.0	4	18.93	9	7.7	9	23.5	2.19	T
1984	1	100		1		1		0		0	22.6	2.80	C
1985	8	50	22.40	3	19.5	2	20.00	4	8.5	4	16.1	2.02	T
1985	2	100		1		0		0		0	14.0	2.74	C
1986	13	69	19.33	9	4.7	9	20.53	4	12.0	3	18.6	2.56	T
1986	0			0		0		0		0	21.9	3.29	C
1987	16	50	21.18	8	7.1	7	19.18	8	4.6	8	20.6	2.64	T
1987	0			0		0		0		0	24.5	5.80	C
1988	15	60	21.00	8	7.6	7	20.26	6	9.7	6	22.4		T
1988	2	50		1		1		1		1	19.7	3.70	C
1989	7	71	19.58	5	5.8	5	19.35	2	9.0	2			T
1989	1	100		1		1		0		0			C
1990	10	70	19.44	7	4.6	5	19.40	3	4.0	3	37.6	4.55	T
1990	0			0		0		0		0	26.2	5.38	C
1991	7	29	22.13	2	4.0	2	20.50	5	10.2	5	23.5	4.32	T
1991	1	100		1		1		0		0	30.5	8.28	C
1992	13	62	20.25	8	7.0	5	16.70	4	2.0	4	17.4		T
1992	1	100		1		1		0		0	27.5		C
1993	14	50	19.13	7		0	19.50	7		0	30.4	4.52	T
1993	5	20		1		0	20.52	4		0	27.6	8.00	C
1994	7	57	21.00	3	9.7	3	19.30	2	9.5	2			T
1994	5	60	20.80	3	4.3	4	18.60	2	8.0	2	22.1	7.80	C
1995	10	60	20.60	6	6.8	5	18.50	4	4.3	4	15.0		T
1995	11	36	21.80	4	10.0	4	19.50	6	7.1	6			C
1996	11	55	19.50	6	4.3	6	18.80	5	8.6	5	26.6	6.50	T
1996	12	42	20.70	5	10.7	4	20.30	6	11.0	6	18.7		C

Year	Reported bear harvest	Male grizzly bears					Female grizzly bears				Moose		Harvest type[a]
		%	Skull size $\bar{x}$	*n*	Age	*n*	Skull size $\bar{x}$	*n*	Age	*n*	Calves/ 100	Calves/ hr	
1997	9	67	20.70	6	7.8	4	19.90	3	12.3	3	26.1	6.00	T
1997	2	50		1		1		1		1	22.8	10.70	C

[a] Treatment: P=pretreatment, T=intensive harvest, and C=little harvest control.

Table 2 A comparison of male skull size and harvest density in the pretreatment versus treatment periods

Test	Hypothesis[a]	Pretreatment	Treatment	*t*-test	Interpretation
Harvest density	H_O: Pre=Treat	5	16	0.0003	Harvest density > during treatment.
	H_A: Pre<Treat			0.0001	Satterthwaite correction.
Male skull size	H_O: Pre=Treat	5	16	0.0003	Male skull size > during pretreatment.
	H_A: Pre<Treat			0.0095	Satterthwaite correction.

[a] Pre=Treat, pretreatment sample is not different from the treatment or intensive harvest sample; Pre<Treat, pretreatment sample is less than the treatment or intensive harvest sample.

Table 3 Unit 20E grizzly bear harvest, regulatory years 1989 through 1998

Regulatory year	Reported							Estimated kill		Total estimated kill			
	Hunter kill				Nonhunting kill[a]								
	M	F	Unk	Total	M	F	Unk	Unreported	Illegal	M (%)	F (%)	Unk	Total
1989–1990													
Fall 1989	4	2	0	6	0	0	0	0	0	4 (67)	2 (33)	0	6
Spring 1990	3	1	0	4	0	0	0	0	0	3 (75)	1 (25)	0	4
Total	7	3	0	10	0	0	0	0	0	7 (70)	3 (30)	0	10
1990–1991													
Fall 1990	7	3	0	10	0	0	0	0	0	7 (70)	3 (30)	0	10
Spring 1991	2	1	0	3	0	0	0	0	0	2 (67)	1 (33)	0	3
Total	9	4	0	13	0	0	0	0	0	9 (69)	4 (31)	0	13
1991–1992													
Fall 1991	2	4	0	6	0	0	0	0	0	2 (33)	4 (67)	0	6
Spring 1992	3	2	0	5	0	0	0	0	0	3 (60)	2 (40)	0	5
Total	5	6	0	11	0	0	0	0	0	5 (45)	6 (55)	0	11
1992–1993													
Fall 1992	7	3	1	11	0	0	0	0	0	7 (64)	3 (27)	1	11
Spring 1993	2	1	0	3	0	0	0	0	0	2 (67)	1 (33)	0	3
Total	9	4	1	14	0	0	0	0	0	9 (64)	4 (29)	1	14
1993–1994													
Fall 1993	9	10	0	19	0	0	0	0	0	9 (47)	10 (53)	0	19
Spring 1994	0	2	0	2	0	0	0	0	0	0 (0)	2 (100)	0	2
Total	9	12	0	21	0	0	0	0	0	9 (43)	12 (57)	0	21
1994–1995													
Fall 1994	6	4	0	10	0	0	0	0	2	8 (75)	4 (25)	0	12
Spring 1995	1	0	0	1	0	0	0	0	0	1 (100)	0 (0)	0	1
Total	7	4	0	11	0	0	0	0	2	9 (69)	4 (31)	0	13
1995–1996													
Fall 1995	6	8	0	14	0	0	0	0	0	6 (43)	8 (57)	0	14
Spring 1996	5	2	0	7	0	0	0	0	0	5 (71)	2 (29)	0	7
Total	11	10	0	21	0	0	0	0	0	11 (52)	10 (48)	0	21
1996–1997													
Fall 1996	8	10	0	18	0	0	0	0	1	9 (47)	10 (53)	0	19
Spring 1997	2	2	0	4	0	0	0	0	0	2 (50)	2 (50)	0	4
Total	10	12	0	22	0	0	0	0	1	11 (48)	12 (52)	0	23

Regulatory year	Reported							Estimated kill		Total estimated kill			
	Hunter kill				Nonhunting kill[a]								
	M	F	Unk	Total	M	F	Unk	Unreported	Illegal	M (%)	F (%)	Unk	Total
1997–1998													
Fall 1996	7	4	0	11	0	0	0	0	1	7 (58)	4 (33)	1	12
Spring 1997	0	0	0	0	0	0	0	0	0	0 (00)	0 (00)	0	0
Total	7	4	0	11	0	0	0	0	1	7 (58)	4 (33)	1	12
1998–1999[b]													
Fall 1998	6	5	0	11	0	0	0	0	0	6 (55)	5 (45)	0	11

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

[b] Preliminary harvest.

Table 4 Unit 20E residency of successful grizzly bear hunters, regulatory years 1989 through 1998

Regulatory year	Resident	(%)	Nonresident	(%)	Unknown	(%)	Total successful hunters
1989–1990	9	(90)	1	(10)	0	(0)	10
1990–1991	12	(92)	1	(8)	0	(0)	13
1991–1992	11	(100)	0	(0)	0	(0)	11
1992–1993	12	(86)	2	(14)	0	(0)	14
1993–1994	20	(95)	1	(5)	0	(0)	21
1994–1995	8	(73)	2	(18)	1	(9)	11
1995–1996	9	(43)	9	(43)	3	(14)	21
1996–1997	21	(91)	2	(9)	0	(0)	23
1997–1998	9	(82)	2	(18)	0	(0)	11
1998–1999[a]	8	(73)	3	(27)	0	(0)	11

[a] Preliminary harvest.

Table 5 Unit 20E brown bear harvest chronology by time period, regulatory years 1989–1990 through 1998–1999[a]

Regulatory year	Harvest periods														
	Aug	(%)	Sep	(%)	Oct	(%)	Nov	(%)	Apr	(%)	May	(%)	Jun	(%)	*n*
1989–1990	1	(10)	5	(50)	0	(0)	0	(0)	1	(10)	2	(20)	1	(10)	10
1990–1991	2	(15)	7	(54)	0	(0)	0	(0)	0	(0)	3	(23)	1	(8)	13
1991–1992	3	(27)	2	(18)	1	(9)	0	(0)	0	(0)	1	(9)	4	(36)	11
1992–1993	4	(29)	5	(36)	2	(14)	0	(0)	0	(0)	1	(7)	2	(14)	14
1993–1994	6	(29)	12	(57)	1	(5)	0	(0)	1	(5)	1	(5)	0	(0)	21
1994–1995	2	(15)	10	(77)	0	(0)	0	(0)	0	(0)			1	(8)	13
1995–1996	3	(14)	10	(48)	0	(0)	0	(0)	1	(5)	6	(29)	1	(5)	21
1996–1997	7	(30)	12	(52)	0	(0)	0	(0)	0	(0)	2	(9)	2	(9)	23
1997–1998	2	(18)	9	(82)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	11
1998–1999[a]	6	(55)	5	(45)	0	(0)	0	(0)							11
Totals	36	(24)	77	(52)	4	(3)	0	(0)	3	(2)	16	(11)	12	(8)	148

[a] Preliminary harvest.

Table 6 Unit 20E grizzly bear harvest percent by transport method, regulatory years 1989–1990 through 1998–1999[a]

Regulatory year	Percent of harvest									
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Walk	Unk	*n*
1989–1990	40	0	10	0	0	0	20	20	10	10
1990–1991	23	0	15	8	0	0	46	0	8	13
1991–1992	27	0	9	18	0	0	36	9	0	11
1992–1993	43	0	0	21	0	7	29	0	0	14
1993–1994	29	0	10	14	0	19	5	24	0	21
1994–1995	23	0	8	31	0	8	15	15	0	13
1995–1996	57	0	10	10	0	4	4	10	4	21
1996–1997	43	4	0	9	0	9	26	9	0	23
1997–1998	45	0	0	45	0	0	0	10	0	11
1998–1999[a]	73	0	0	0	0	18	0	9	0	11

[a] Preliminary harvest.

LOCATION

GAME MANAGEMENT UNITS: 21B, C, and D (20,655 mi^2)

GEOGRAPHIC DESCRIPTION: Middle Yukon River, including lower Koyukuk River, lower Nowitna River and Melozitna River drainages

BACKGROUND

Grizzly bears are in low to moderate numbers throughout the area, but most inhabit the mountainous areas. Populations have been stable or slowly increasing with annual reported harvests of <10 bears per year. An equal number of grizzly bears are thought killed but unreported, stemming from bear/human conflicts. Unreported kills most likely occur along the Yukon River during the summer and early fall, when fish camps are in operation and bears are attracted to the sites.

Historically, grizzly bears were an important source of food and hides, but hunting effort by local residents has declined in recent years. The registration regulations and fee exemption for the Northwest Alaska Brown Bear Management Area, which includes all of Unit 21D, has improved harvest reporting among local residents.

This report now covers Units 21B, C, and D. Previous management reports included all 5 subunits of Unit 21.

MANAGEMENT DIRECTION

MANAGEMENT GOAL

- Protect, maintain, and enhance the grizzly bear population and its habitat in concert with other components of the ecosystem.

MANAGEMENT OBJECTIVES

- Manage a grizzly population that will sustain a minimum annual harvest of 10 bears.

- Increase compliance with bear sealing requirements by local hunters, reduce the bear-human conflicts that arise at summer fish camps along the Yukon River, and determine the amount of unreported harvest.

METHODS

The reported harvest was monitored through sealing requirements of general hunts and through reporting requirements of the Northwest Alaska Brown Bear Management Area subsistence hunts. Data collected during sealing includes sex, location of harvest, skull measurements, and age if teeth are submitted for aging. Data specific to harvest such as transportation methods, time of harvest, and commercial services utilized was also recorded. Data collected from bears harvested under subsistence regulations was limited to sex and location and date of harvest.

Bear/human conflicts were addressed through education, legal harvest of problem bears, and changes in regulations. Harvest data were summarized by regulatory year (RY = 1 July–30 June).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Field observations, nuisance reports, and hunter sightings indicated the population was stable or slowly increasing during the past 10 years. We did not complete any surveys in the area; however, we made population estimates based on known bear densities in similar habitats in other Interior Alaska game management units (Reynolds and Hechtel 1984; Reynolds 1989). An estimated 350–400 inhabited Units 21B, C, and D assuming 25 bear/1000 mi^2 were present in the highest density bear habitat and 10 bears/1000 mi^2 were present in the rest of the area (Woolington 1997) (21B≅50, 21C≅100, 21D≅200). The Nulato Hills portion of Unit 21D is the best bear habitat; Unit 21C in its entirety is the next best. However, because bears in most of these areas have access to spawning salmon and the density estimates were low in comparison with other areas with similar habitat (Miller 1993), it is likely that those figures were underestimates.

MORTALITY

Harvest

Seasons and Bag Limits.

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 21, except 21D		
1 bear every 4 regulatory years	1 Sep–31 May	1 Sep–31 May
Unit 21D		
1 bear every regulatory year by registration permit.	1 Sep–31 May (Subsistence hunt only)	No open season
One bear every 4 regulatory years	1 Sep–31 May	1 Sep–31 May

Board of Game Actions and Emergency Orders. During the spring 1996 Board of Game meeting, Unit 21D was included within the Northwest Alaska Brown Bear Management Area. This regulation change allowed a bag limit of 1 bear every regulatory year under a subsistence registration permit. This regulation also required salvage of meat for human consumption, but the hide and skull did not need to be sealed unless they were removed from the management area. If the hide was removed from the management area, the Alaska Department of Fish and Game took the skin of the head and the front claws.

Hunter Harvest. Harvest of grizzly bears in Units 21B, C, and D was low, and no harvest patterns were clear over the last 6 regulatory years (Table 1). Males comprised 61% of the reported

harvest, an adequate level to maintain recruitment. More than half the annual harvest was likely unreported. The number of bears that were taken and not reported was unknown, but I estimated it was <10 bears per year, based on previously reported values. Most were likely taken at fish camps. If this rough estimate is accurate, then the combined mean annual harvest for the last 6 regulatory years would be 17 bears/year. However, known harvest data show little indication of overexploitation. An annual total harvest of 25 bears is probably sustainable (approximately 6.5% of the estimated population).

Among subunits, most harvest was in Unit 21D where the highest level of moose hunting also occurs (Table 2). Unit 21C sustained the second greatest harvest, which was supported by the relatively high density of bears in that area.

Hunter Residency and Success. There was no set pattern of harvest among user groups (Table 3) because most grizzly bears were harvested opportunistically. Mean annual harvest over the past 6 regulatory years was 2.0, 1.5, and 3.0 bears for local, nonlocal, and nonresident hunters, respectively. Mean annual number of successful hunters was 7.

Harvest Chronology and Transport Methods. Because harvest of bears was low, no patterns demonstrating greater harvest during the spring versus fall harvest was apparent. Spring bear hunters typically use snowmachines for transportation. Fall bear harvest is often incidental to moose hunting activity, and hunters typically use boats for transportation.

CONCLUSIONS AND RECOMMENDATIONS

The first objective for grizzly bears was to manage for a population that will sustain a minimum reported harvest of 10 bears annually. This objective was achieved; the population was probably large enough to support the reported harvest of ≤ 10 bears. The combined (reported and unreported) harvest never exceeded the estimated sustainable yield (25 bears). Unless regulations or hunting habits change dramatically, the harvest will have a negligible effect on grizzly populations in these units. The bear sealing compliance and education at fish camps portions of the second objective were not satisfied. No education programs were conducted for schools or for Yukon River residents that operated fish camps. Both a more accurate assessment of the amount of unreported harvest and a more critical evaluation of density estimates should be addressed in the next reporting period.

The harvest management objectives for the next reporting period will be changed to reflect the inclusion of the estimated annual unreported harvest to the annual reported harvest and will only pertain to Units 21B, C, and D.

The new management objective will be as follows:

- Manage a grizzly population that will sustain a 3-year mean annual harvest of at least 25 bears, with at least 50% males in the reported harvest.

The need to promote bear conservation with the public remains very important, so education will be a priority. The objective to reduce human/bear conflicts was eliminated because it is difficult to quantify reductions and because the level of unreported mortality is small relative to the size of

the bear population. Additionally, improved reporting as a result of the Northwest Alaska Brown Bear Management Area regulations and education efforts are expected to reduce that component of the harvest.

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PREPARED BY:

Glenn W Stout
Wildlife Biologist II

SUBMITTED BY:

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Harry V Reynolds, III
Wildlife Biologist III

Table 1 Units 21B, C, and D grizzly bear harvest, regulatory years 1992–1993 through fall 1998

Regulatory year	Reported								Estimated kill		Total estimated kill			
	Hunter kill				Nonhunting kill[a]									
	M	F	Unk	Total	M	F	Unk	Total	Unreported	Illegal	M	F	Unk	Total
1992–1993														
Fall 1992	0	2	0	2	0	0	0	0	5	0	0	2	5	7
Spring 1993	6	1	0	7	0	0	0	0	5	0	6	1	5	12
Total	6	3	0	9	0	0	0	0	10	0	6	3	10	19
1993–1994														
Fall 1993	1	2	0	3	0	0	0	0	5	0	1	2	5	8
Spring 1994	3	0	0	3	0	0	0	0	5	0	3	0	5	8
Total	4	2	0	6	0	0	0	0	10	0	4	2	10	16
1994–1995														
Fall 1994	1	3	0	4	0	0	0	0	5	0	1	3	5	9
Spring 1995	3	1	0	4	0	0	0	0	5	0	3	1	5	9
Total	4	4	0	8	0	0	0	0	10	0	4	4	10	18
1995–1996														
Fall 1995	0	1	0	1	0	0	0	0	5	0	0	1	5	6
Spring 1996	1	2	0	3	0	0	0	0	5	1	2	2	5	9
Total	1	3	0	4	0	0	0	0	10	0	2	3	10	15
1996–1997														
Fall 1996	2	1	0	3	1	0	0	1	5	0	3	1	5	9
Spring 1997	0	0	0	0	0	0	0	0	5	0	0	0	5	5
Total	2	1	0	3	1	0	0	1	10	0	3	1	10	14
1997–1998														
Fall 1997	4	2	3	9	0	0	0	0	5	0	4	2	8	14
Spring 1998	1	0	0	1	0	0	0	0	5	0	1	0	5	6
Total	5	2	3	10	0	0	0	0	10	0	5	2	13	20
1998–1999														
Fall 1998	1	2	0	3	1	0	1	2	5	0	2	2	6	10

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

Table 2 Unit 21 reported bear harvest by subunit, regulatory years 1992–1993 through fall 1998[a]

Regulatory year	Unit			Total
	21B	21C	21D	
1992–1993	2	0	7	9
1993–1994	0	2	4	6
1994–1995	0	3	5	8
1995–1996	0	0	4	4
1996–1997	1	2	0	3
1997–1998	1	1	8	10
Fall 1998	0	2	1	3
Total	4	10	28	42

[a] Nonhunting kill not included.

Table 3 Unit 21B, C, and D successful hunter residency, regulatory years 1992–1993 through fall 1998

Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Total successful hunters
1992–1993	2	1	6	9
1993–1994	2	2	2	6
1994–1995	2	3	3	8
1995–1996	2	0	2	4
1996–1997	1	2	0	3
1997–1998	4	1	5	10
Fall 1998[b]	2	1	2	3

[a] Unit 21B, C, and D residents.
[b] Preliminary.

LOCATION

GAME MANAGEMENT UNIT: 22 (25,200 mi^2)

GEOGRAPHIC DESCRIPTION: Seward Peninsula and that portion of the Nulato Hills draining west into Norton Sound

BACKGROUND

We believe that Unit 22 brown bear numbers declined during the early 1900s after the introduction of the gold mining and reindeer herding industries. It was not until these activities declined substantially during the 1940s that bear numbers began to slowly recover (Grauvogel 1986). The population has since continued to increase in most areas, presumably in response to higher prey densities and conservative management policies.

Interest in harvesting bears by recreational hunters, principally from the Nome area and by nonresident trophy hunters remains high. Human-bear encounters in and on the periphery of Unit 22 villages are increasingly common and reindeer herders report that predation by brown bears on reindeer continues to be a significant problem. Confrontations between bears and individuals involved in outdoor activities such as camping, fishing, hunting and mining occur frequently, and many local residents believe that bear densities in Unit 22 are excessive.

MANAGEMENT DIRECTION

MANAGEMENT GOALS AND OBJECTIVES

The following management goals and objectives have been established for brown bear populations in Unit 22:

- Maintain brown bear populations at levels estimated during the 1991 bear research study and census. The density estimate for adult brown bears in the study area in Unit 22C and portions of 22B and 22D was 1 bear per 27 mi^2.
- Seal bears and monitor the harvest.
- Improve compliance with bear harvest reporting requirements and develop an alternate harvest reporting system to improve accuracy of harvest data.
- Provide opportunity for subsistence hunting of brown bears.
- Minimize conflicts between bears and the public.

METHODS

Assessments of population status were derived from observations made during radiotelemetry flights and surveys of other game species. Information was also gathered through general

conversation with knowledgeable local residents. Harvest data were summarized from sealing certificates and nonresident permit harvest reports. Nuisance bear problems were addressed through education and by working with Village Public Safety Officers (VPSO) to deter or destroy problem bears. Regulatory changes were initiated to liberalize bear hunting in much of the unit.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We believe that grizzly bear numbers are increasing throughout much of Unit 22 and are probably above densities previously estimated. A bear research study and census, completed during the early 1990s, provided population estimates for a 12,509 mi^2 study area located in northern Unit 22C, western Unit 22B, eastern Unit 22D, and southern Unit 22E. (Miller and Nelson 1993). The population estimate of brown bears older than 2-year-olds was 458 bears (density: 1 bear per 27 mi^2). The density varied almost two-fold within the study area with the highest densities (1 bear per 20 mi^2) in the western portion of Unit 22B, and the lowest densities (1 bear per 39 mi^2) in the southern portion of Unit 22E

The study area did not include Unit 22A or eastern Unit 22B. In an attempt to derive a crude density estimate of grizzly bears in Unit 22, Nelson (1993) combined the density estimate for all bears in the western portion of the unit with estimates derived from discussions with several knowledgeable local residents in the eastern portion of the unit. He estimated that the Unit 22 bear population size and density ranged from approximately 851 bears (1 bear per 26 mi^2) to 1086 bears (1 bear per 21 mi^2) for bears of all ages. Because of the subjective approach used to calculate the overall density estimate for Unit 22, these estimates should be regarded with caution.

Since 1985, the annual reported brown bear harvest from Unit 22 has ranged from 42–67 bears, averaging 53 bears per year. Although we have no definitive data, indications are that even with such high harvests the population has gradually increased in recent years throughout much of the unit. Observations by staff, and reports from hunters, guides and long time unit residents point out more frequent bear sightings and encounters, and problems with bears in areas were bears previously were seldom seen and not a problem. Residents of Wales report they now regularly see bears in the area around Wales and in the last few years have for the first time had brown bears raid their camps. People from Teller, Brevig Mission, and camps at Cape Wooley report increasing problems with bears, including destruction of cabins and raids on subsistence food caches.

Other indicators point to a healthy, productive bear population. We observed and received reports of numerous separate sightings of sows with three cubs, often in their second year. Last year we had two reports from reliable sources of sows with four cubs, one in Unit 22A and one in Unit 22D. The proportion of male bears in the harvest has remained relatively high compared with the proportion of females in the harvest (Figure 1). The trendline of the average age of harvested bears has remained constant since Unit 22 harvest records began in

1967 (Figure 2). We believe that we have a productive population with an abundance of bears of younger age classes that are often less wary and more likely to inhabit accessible areas and to venture into areas of human habitation.

MORTALITY

Harvest

Season and Bag Limit.

1996–1997 and 1997–1998 Regulatory Year Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 22(A) **RESIDENT HUNTERS:** One bear every 4 regulatory years	1 Sep–31 Oct 15 Apr–25 May	
NONRESIDENT HUNTERS: One bear every 4 regulatory years		1 Sep–31 Oct 15 Apr–25 May
Unit 22(B) **RESIDENT HUNTERS:** One bear every 4 regulatory years	1 Sep–31 Oct 15 Apr–25 May	
NONRESIDENT HUNTERS: One bear every 4 regulatory years by drawing permit only. Up to 20 permits maybe issued in combination with Unit 22C.		1 Sep–31 Oct 15 Apr–25 May
Unit 22(C) **RESIDENT HUNTERS:** One bear every 4 regulatory years	1 Sep–31 Oct 10 May–25 May	
NONRESIDENT HUNTERS: One bear every 4 regulatory years by drawing permit only. Up to 20 permits maybe issued in combination with Unit 22B.		1 Sep–31 Oct 10 May–25 May
Unit 22(D) **RESIDENT HUNTERS:** One bear every 4 regulatory years	1 Sep–31 Oct 15 Apr–25 May	
NONRESIDENT HUNTERS: One bear every 4 regulatory years by drawing permit only.		1 Sep–31 Oct 15 Apr–25 May

1996–1997 and 1997–1998 Regulatory Year Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
years by drawing permit only. Up to 5 permits maybe issued in combination with Unit 22E.		
Unit 22(E) **RESIDENT HUNTERS:** One bear every 4 regulatory years	1 Sep–31 Oct 15 Apr–25 May	
NONRESIDENT HUNTERS: One bear every 4 regulatory years by drawing permit only. Up to 5 permits maybe issued in combination with Unit 22D.		1 Sep–31 Oct 15 Apr–25 May

Human-Induced Mortality. The harvest of bears taken in Unit 22 under current regulations is largely recreational, although data indicate that a small amount of subsistence use of grizzly bears occurs in Unit 22 (Conger *et al.* 1990). The annual harvest during the 2-year reporting period was 58 bears during the 1996–1997 regulatory year, and 59 bears during the 1997–1998 regulatory year (Tables 1 and 2). Historically, more bears are taken during the spring season because bears are more easily observed, hunter effort is greater, and bears tend to be more accessible to hunters using snowmachines as transportation (Nelson 1993). However, during this reporting period the harvest was split equally between the spring and fall. The 1996–1997 regulatory year was an anomaly with two factors contributing to this situation. An unusually large number of bears were taken in the fall of 1996 in the Council area in Unit 22B where bears congregated to feed on abundant salmon, and an unusually early snow melt in the spring of 1997 ended snow machine travel early in the season, limiting hunting opportunity.

Historical harvest data collected since the sealing requirement was instituted in the early 1960s indicate that more male bears have been harvested than females (Figure 1). The harvest during the current reporting period was no exception. Sex composition of the harvest from fall 1996 through spring 1998 was 63% males and 37% females.

The trendline of the average age of harvested bears has remained constant at 6.5 years since Unit 22 age records began in 1967 (Figure 2). The average ages of bears harvested in the spring are consistently higher than those taken in the fall. The fall hunt generally targets bears in the most accessible places where most of the older, larger bears have now been eliminated. Much of the harvest is by local recreational hunters who are not selective and shoot whatever bear first presents itself.

Ten bears were reported as non-hunting kills during the 2-year reporting period (Table 1), 9 were taken in defense of life and property (DLP) and one was a mercy killing. This is a greater

number of DLP bears than previously reported. Whether this represents an actual increase in the number of bears killed or better compliance with reporting is unknown. These totals do not represent the actual number of non-hunting kills for the reporting period. Each year, we receive unverified reports of bears being shot and left unattended, or of not being sealed. The accuracy of these reports is unknown. Nelson (1993) estimated that an additional 10 to 30 bears were killed annually and not reported in Unit 22.

In an attempt to better document unreported harvest in the villages, bear sealing agents were set up in Shishmaref and White Mountain to make sealing bears more convenient for village residents. Efforts continue to find reliable agents in other villages. Also, a cooperative harvest assessment project that will use village surveys to quantify harvest of game species, including bears, is being developed with Subsistence Division and Kawerak Native Corporation. The first surveys will begin in April 1999 in several Unit 22 villages.

On a number of occasions VPSOs were asked to help with problem bears in and around unit villages. In some instances deterrents such as rubber bullets where effective, in other cases where efforts to drive bears away failed, they were advised to kill the bear. As bear problems in and around villages and camps become increasingly common, more effort needs to be applied to educating the public about bear behavior, bears deterrents and the importance of clean camps.

Permit Hunts. In 1980, the Board of Game adopted regulations requiring drawing permits for nonresident brown bear hunts in Unit 22. The following year, the Board eliminated the drawing permit requirement in Unit 22A. During the period 1980–1992, 20 drawing permits (10 in the spring and 10 in the fall) were available annually to nonresidents for Units 22B, 22C, 22D, and 22E. Since 1992, 20 drawing permits have been allocated to nonresident hunters in Units 22B and 22C in combination, and 5 permits to nonresidents in Units 22D and 22E in combination. Most nonresidents who receive drawing permits hunt with registered guides. All qualified drawing permit applicants are maintained on alternate lists and permits are issued to alternates in ranked order if drawing permit winners decline their permits and chose not to hunt.

Hunter Residency and Success. Hunter residency and success is influenced by nonresident drawing permit requirements in Unit 22. In Unit 22A where nonresident drawing permits are not required, the size of the nonresident harvest surpasses the resident harvest. In the remainder of the Unit where nonresident effort has been restricted by a drawing permit quota (13 in the spring and 12 in the fall), the size of the resident harvest normally exceeds the nonresident harvest (Table 3). These data also indicate that local unit residents typically harvest more bears annually than nonlocal resident hunters.

Nonresident hunter success rates vary with the season and the drawing hunt being considered. Since 1992, approximately 57% of the nonresident permits have been filled. During this reporting period, in Units 22B and 22C, 43% of the nonresident permits were filled. During the fall seasons in Units 22B and 22C, 45% of the permittees bagged a bear, 15% were unsuccessful and 40% didn't hunt. Nonresident spring hunters were uncharacteristically less successful; 40% harvested a bear, 15% were unsuccessful and 45% didn't hunt. This can be

partly attributed to poor hunting conditions in the spring of 1997. In Units 22D and 22E, 50% of the nonresident permits were filled during the reporting period. Twenty-five percent of the fall nonresident hunters harvested a bear. In the spring hunts 67% of the nonresident hunters were successful.

We cannot easily evaluate hunter effort and success for resident hunters under the present harvest reporting system because unsuccessful hunters are not required to report. Conversations with some unit residents who have hunted bears in the past indicate that hunter success is normally higher in the spring, particularly when suitable snow conditions exist for snowmachine travel and tracking.

Harvest Chronology. The spring bear harvest typically exceeds the fall harvest as seen in 1997–1998. The 1996–1997 regulatory year was an exception (Table 2). This resulted from an unusually large fall harvest of bears along the Niukluk River, where they congregated to feed on plentiful pink salmon, and from poor spring traveling conditions that curtailed snowmachine travel early in the hunting season. Generally, local hunters prefer to hunt bears in the spring when snow cover is present because of easier access using snowmachines, and bears are easier to locate and track. During the fall, access is more limited, bears are usually more difficult to find, and hunters tend to be less selective.

Transport Methods. The 3 road systems located in Unit 22 make it possible for bear hunters to reach suitable habitat either with a highway vehicle alone or by using the roads as access points for boats, ORVs and snowmobiles. The number of bears harvested along the road corridors using a highway vehicle only for transportation increased during this reporting period (Table 4). This may be due to an overall increase in the number of bears in Unit 22, particularly as younger bears disperse and inhabit areas frequented by people. Of the 22 bears taken with a highway vehicle only, 78% were 3 years of age or younger. Aircraft use in the unit is primarily limited to registered guides moving clients in and out of camps. Other transport methods are used from the camps.

Board of Game Actions and Emergency Orders. In October 1997 the Board approved two regulatory changes recommended by the Department that, effective 1 July 1998, increased bear hunting opportunity in Unit 22. One regulatory change added Unit 22, except Unit 22C, to the Northwest Alaska Brown Bear Management Area that allows subsistence hunters to harvest 1 bear per regulatory year for food from 1 Sep–31 May by registration permit. The other regulatory change adopted by the board lengthened the general and drawing hunt season to 1 Sep–31 May in Unit 22, except Unit 22C where the season remains 1 Sep–31 Oct and 10 May –25 May.

Inclusion of Unit 22 (except Unit 22C) in the Northwest Alaska Brown Bear Management Area is intended to legalize a small amount of subsistence brown bear hunting that already occurs and is not expected to significantly increase harvest. The free registration permits for subsistence may also be used by people who don't intend to hunt bears but want to be able to keep the hide and skull if they are forced to kill a bear in defense of life and property, provided the meat is salvaged. It is hoped that these permits will increase reporting of subsistence and some DLP harvest that is currently undocumented.

Lengthening the bear season will probably slightly increase harvest by resident hunters and the success rate of nonresident hunters. The greatest additional harvest will likely occur in the spring if warm weather brings bears out of the den earlier than mid-April when the spring bear season previously opened. This harvest period will target male bears that emerge from the den earlier in the season. Nonresident drawing permittees will be able to choose when they prefer to hunt and if they are unsuccessful on a fall hunt they will have the opportunity to return in the spring and try again.

Neither of these changes was recommended for Unit 22C. There is already a relatively high harvest of bears in Unit 22C and it was feared that the large population of Nome and good road access within Unit 22C would lead to overharvest. Additional hunting in early April would target large males and that segment of the population has already been overharvested in areas close to Nome.

CONCLUSIONS AND RECOMMENDATIONS

Brown bears continue to be a controversial species in Unit 22. Interest in trophy hunting brown bears remains high among Nome hunters and the Unit is a popular destination for non-local resident and nonresident bear hunters. As nuisance bear encounters become more frequent advisory committees and many unit residents are increasingly vocal about their desire to see bear numbers reduced. Although, definitive data are lacking, we believe that bear densities in many parts of the unit have increased above desired levels and above densities documented in the bear census and research study conducted in the early 1990s.

Although local residents often express concern that increasing bear numbers are a major cause of moose mortality, moose populations are believed to be recovering from declines caused by severe winters in the early 1990s and moose numbers appear to be stable or increasing throughout the unit. Over the last 12 years the success rate of moose hunters has remained relatively stable, between 40–50%.

Recognizing that Unit 22 has a healthy bear population that can withstand additional harvest, the Department recommended and the Board of Game adopted, two regulatory changes intended to increase bear hunting opportunity. As of 1 July 1998, Unit 22 (excluding Unit 22C) became part of the Northwest Alaska Brown Bear Management Area, which allows yearly harvest of brown bears for food with a registration permit. Also, the general and drawing hunt seasons in Unit 22 (except in 22C) were lengthened and aligned with the subsistence season, both running from 1 Sep–31 May. No changes in regulations were recommended or adopted in Unit 22C where overharvest by Nome hunters is a concern. No further regulatory changes are recommended until we analyze effects of these changes.

Harvest reporting in Unit 22 falls into 2 categories: sealing of bears taken during established hunting seasons; and, reporting of bears killed in defense of life and property. Compliance in both categories is high for the community of Nome. However, compliance with harvest reporting and sealing requirements in the surrounding rural villages remains low. Several changes were implemented during this reporting period to address the problem. In addition to our bear-sealing agent in Unalakleet, sealing agents were set up in Shishmaref and White

Mountain and efforts continue to find agents in other villages. It is hoped that the subsistence hunt by registration permit may increase reporting for a portion of the harvest that is now undocumented. In April 1999 a cooperative harvest assessment project that will use village surveys to quantify harvest of bears and other game species is scheduled to begin in several Unit 22 villages.

It is an enormous challenge to manage a healthy bear population in such a way that the traditional subsistence activities of Seward Peninsula people are not unduly disrupted by bears. Bear densities on the Seward Peninsula have gradually increased since a period earlier this century when the reindeer herding and mining industries and predator control efforts kept bear numbers very low. Many long time residents, especially in the western part of the unit, are not accustomed to having to take bear precautions near their villages and at their camps. Traditional food storage practices often attract bears in the area and if camps or caches are left unattended, bears help themselves, learning to associate food with human habitation. It is important to increase educational efforts aimed at understanding bear behavior, bear safety and minimizing bear/human conflicts, emphasizing the importance of clean camps and not leaving food, dog food, scraps or garbage unattended or accessible to bears.

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PREPARED BY:

Kate Persons
Wildlife Biologist II

SUBMITTED BY:

Peter J. Bente
Survey-Inventory Coordinator

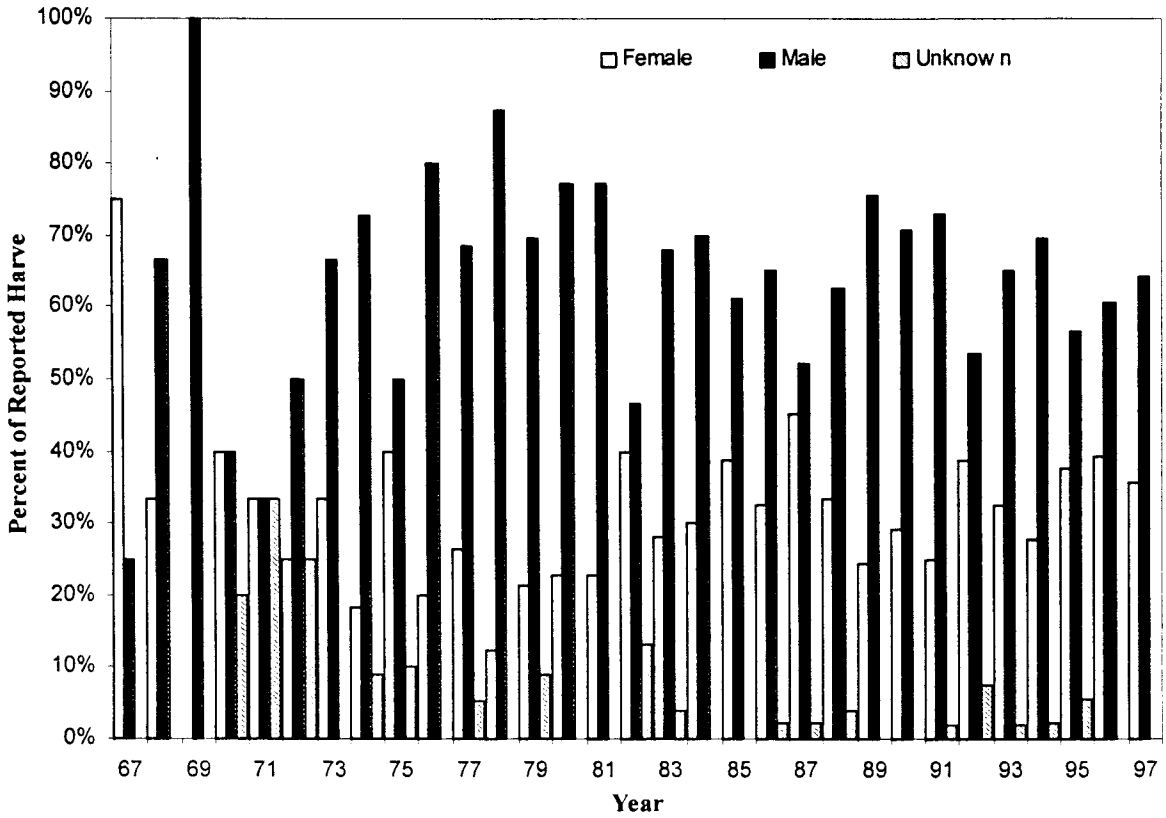

Figure 1 Reported brown bear harvest by sex in Unit 22, 1967–1998

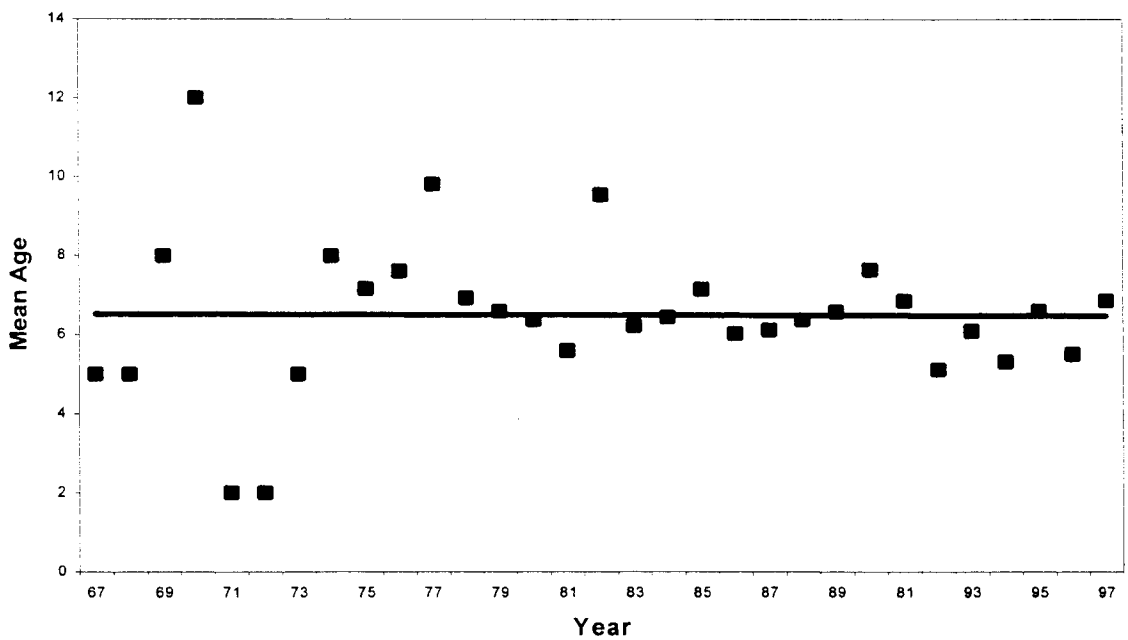

Figure 2 Trend of mean age of reported brown bear harvest in Unit 22, 1967 – 1998

Table 1 Unit 22 brown bear harvest[a] for regulatory years 1996–1997 and 1997–1998

Regulatory year	Reported harvest											
	Hunter kill				Non-hunting kill				Total kill			
	M	F	Unk.	Total	M	F	Unk.	Total	M	F	Unk.	Total
1996–1997												
Fall 1996	16	17	0	33	0	2	0	2	16	19	0	35
Spring 1997	20	5	0	25	1	0	0	1	21	5	0	26
Total	36	22	0	58	1	2	0	3	37	24	0	61
1997–1998												
Fall 1997	13	12	0	25	1	3	0	4	14	15	0	29
Spring 1998	25	9	0	34	2	1	0	3	27	10	0	37
Total	38	21	0	59	3	4	0	7	41	25	0	66

[a] Figures include nonresident permit hunt harvest.

[b] Represents the total known harvest.

Table 2 Sex of Unit 22 brown bear harvest for regulatory years 1996–1997 and 1997–1998

Regulatory year	Game Management Unit											
	22A		22B		22C		22D		22E		Total	
	M	F	M	F	M	F	M	F	M	F	M	F
1996–1997												
Fall 1996	6	3	6	8	4	2	0	4	0	0	16	17
Spring	5	1	6	2	4	1	2	0	3	1	20	5
1997–1998												
Fall 1997	7	3	2	5	2	1	2	3	0	0	13	12
Spring	6	0	10	5	2	2	4	2	3	0	25	9

Table 3 Number, residency and success rates of brown bear hunters in Unit 22 for regulatory years 1996–1997 and 1997–1998

Regulatory Year	Successful hunters						
	Local Residents		Nonlocal Residents		Nonresidents		Total
	(*n*)	%	(*n*)	%	(*n*)	%	%
1996–1997	25	44%	10	17%	23	39%	58
1997–1998	30	51%	5	8%	24	41%	59

[a] Hunters residing in Unit 22

Table 4 Unit 22 brown bear harvest by transport method for regulatory years 1993–1997

Regulatory year	Number harvested							
	Airplane	Boat	Snowmachine	ORV	Highway vehicle	Walk	Unknown	Total (*n*)
1993	7	4	20	8	5	0	0	44
1994	1	4	27	6	4	0	0	42
1995	7	1	29	6	5	0	0	48
1996	9	5	14	15	12	3	0	58
1997	7	6	28	8	10	0	0	59

LOCATION

GAME MANAGEMENT UNIT: 23 (43,000 mi^2)

GEOGRAPHIC DESCRIPTION: Kotzebue Sound and western Brooks Range

BACKGROUND

In 1961 the department established brown bear hunting regulations and sealing requirements in Unit 23. The Board of Game created regulations under the assumption that the primary use of brown bears was for sport and trophy hunting. However, Inupiat hunters in inland communities of Unit 23 traditionally harvested brown bears for meat, fat and hides (Loon and Georgette 1989). In response to frustration expressed by the public over hunting regulations for brown bears and other species, department staff began an extensive regulation review in Unit 23 in 1988. This review recognized local harvest methods and provided the basis for establishing the Northwest Alaska Brown Bear Management Area (NWABBMA) subsistence registration hunt in 1992. Since 1992, 3 brown bear hunts have existed in Unit 23: a drawing permit hunt for nonresident hunters seeking trophy hunting opportunities, a general season trophy hunt for residents, and a subsistence registration permit hunt for residents.

Biological research on brown bears in Unit 23 consists of a baseline study of density, movements, and productivity of bears in the vicinity of the Red Dog Mine (Ballard et al. 1991).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

The primary management goal for brown bears in Unit 23 is to maintain a minimum density of one adult bear per 25.7 mi^2 in the Noatak drainage. Our second goal is to improve the accuracy of harvest information.

MANAGEMENT OBJECTIVES

- Conduct a census in the Noatak drainage before further mining development occurs. The census should be comparable to the census completed in 1987.
- Develop an alternative technique to assess trends in brown bear abundance that does not depend on radiocollaring bears. Total cost, impact on animals, statistical validity, and 3-5 year repeatability should be considered in the design. Estimates of abundance should be sensitive enough to alert biologists of potential population problems.
- Implement a community-based harvest reporting system acceptable to rural residents by 2002 to improve the accuracy of harvest data. Develop a means of evaluating the system's accuracy, feasibility, and cost effectiveness.

METHODS

We obtained harvest information from sealing documents and harvest reports. We continued our efforts to inform Unit 23 residents about the registration subsistence hunt. Kotzebue staff contacted registration permit holders that did not respond to the first harvest report letter by phone. We gave these hunters the option of registering for the following year's hunt by mail.

We based the population status of bears in Unit 23 on information from unit residents and staff observations.

During April and May 1996 and 1997, the Selawik National Wildlife Refuge (FWS) continued a feasibility study to determine if dens could be used to monitor brown and black bear abundance.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Hunters and other residents reported brown bears in most areas to be abundant and stable at levels reached between 1990–1992. In the Noatak drainage, residents felt bear numbers continued to increase. Food sources for brown bears continued to be abundant with high salmon returns, high berry production, and large numbers of ungulates available throughout the unit. Department and NPS staff conducted the last population census in 1986 and found a density of one adult bear (2.5+ years) per 25.7 mi^2 in the vicinity of the Red Dog Mine (Ballard et al. 1991). Based on staff and public observations we feel the density of bears in this area is now higher.

Attempts to use den-count data to establish trends in brown bear abundance in the Selawik drainage have been unsuccessful due to poor snow cover, presence of large numbers of caribou, black bears denning in the same area, and the requirement of long periods of suitable weather (G. Peltola, personal commun.). Refuge staff are preparing a final report evaluating the technique. It is not unlikely this technique will have applications in the unit.

MORTALITY

Harvest

Season and Bag Limit.

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 23 – General Hunt		
Residents: One bear every four regulatory years	1 Sep–10 Oct 15 Apr– 25 May	
Nonresidents: One bear every four regulatory years by drawing permit		1 Sep–10 Oct 15 Apr– 25 May
Unit 23 – Subsistence Hunt	1 Sep–31 May	

Residents: One bear per regulatory year by registration permit in the Northwest Alaska Brown Bear Management Area for subsistence purposes

Nonresidents: No open season

During the reporting period, we issued 25 nonresident drawing permits annually: 7 in the spring and 18 in the fall.

Resident hunters may hunt brown bears in Unit 23 using general season regulations or subsistence hunt registration permits. General season hunters have a bag limit of one bear per four regulatory years and are required to use a big game tag and seal the hide and skull. Subsistence hunting is allowed in the NWABBMA under a subsistence registration permit. This management area consists of Unit 23 excluding the Baldwin Peninsula north of the Arctic Circle, Unit 24 west of the Dalton Highway Corridor, and Unit 26A. Under regulations effective July 1992, residents may harvest one bear per regulatory year from 1 September-31 May without a big game tag. Hunters may not use aircraft for transportation to the field and must salvage all meat for human consumption. They do not need to salvage the hide or skull; however, if the hide or skull is salvaged and transported out of the management area they must be sealed. When sealing hides that leave the management area, department staff will remove the head and front claws to destroy its trophy value.

Board of Game Actions and Emergency Orders. At the spring 1996 Board meeting, residents of Unit 21D and the remainder of Unit 24 requested these units be added to the NWABBMA. This was approved and became effective fall 1996. At the fall 1997 Board meeting, Unit 22 (except 22C) was also added to the management area. At the end of this reporting period the NWABBMA consisted of Units 21D, 22 (except 22C) 23 (except Baldwin Peninsula north of Arctic Circle), 24, and 26A.

Two other brown bear regulations were authorized at the fall 1997 Board meeting. The resident general season was changed from separate fall and spring seasons to one season from 1 September-31 May. The second action increased the number of spring nonresident drawing permits from 7 to 18 and extended the nonresident season from 15 May to31 May. The board took these actions to respond to public and staff concerns over the impact of an increasing brown bear population on people and moose populations.

Hunter/Trapper Harvest. In 1996–1997, hunters killed 29 bears (18 males, 8 females, and 3 unknown sex) (Table 1). Five of 29 bears were harvested by hunters with subsistence registration permits. In 1997–1998, hunters killed 28 bears (21 males and 7 females). Hunters participating in the subsistence registration hunt took 2 of 28 bears.

As in previous years, hunters harvested a larger percentage of males than females, especially in the spring (Table 1). Considering the low percentage of harvest reported by local hunters (Loon and Georgette 1989), the value of sex and age information from reported harvest is

questionable. Indicators based on sex and age of harvested bears are insensitive to and often lag behind changes in bear populations (Miller and Miller 1988). Bear hunters in Unit 23 do not appear to be as selective for large males as they are in other units. Many hunters that harvest bears are not actively hunting them but purchase a tag in case a bear becomes a problem at their camp. Given the high proportion of unreported harvest and hunting characteristics of Unit 23 hunters, harvest data is of little value for population monitoring.

Permit Hunts. The demand by nonresidents for fall brown bear permits exceeded the 18 permits available by 20 in 1996–97 and 11 in 1997–98. There were 8 applicants for the 7 spring bear permit in 1996–97.Only 2 applicants applied for the 7 spring 1997–98 permits so 5 permits were issued over the counter. The success rates for nonresident hunters during 1996-97 and 1997-98 regulatory years were 31% and 44% in fall hunts and 43% and 50% for spring hunts, respectively. These two years are some of the lowest spring success rates the unit has experienced (Table 2). Only 1 fall permit holder did not hunt in 1996–1997, and 3 did not hunt in 1997–1998 fall hunt.

Participation in the NWABBMA registration hunt continues to be primarily by residents of the management area (Table 3). In the past Unit 23 hunters harvested the majority of bears; however, more bears were harvested in Unit 21D the first year it was added to the management area. We expect harvest to decline as the hunt becomes established as it did in Unit 23. The harvest continues to be low (6 bears) and evenly divided between spring and fall (Table 5). Overall harvest levels do not appear to have increased as a result of this subsistence brown bear registration hunt (Table 6).

Staff and vendor efforts probably influence hunter participation in the subsistence registration hunt. Hunters are offered an opportunity to receive a permit by mail for the next year's hunt when they report their harvest. Several hunters, especially those living in villages without vendors, take advantage of this option. We found one reminder letter followed by a telephone call resulted in high reporting compliance for those who picked up permits (73–87%). Hunters who have participated in the permit system support the subsistence hunt. Although subsistence harvest studies conducted in 1987 estimated upper Kobuk villages harvest between 11 and 15 brown bears annually for human consumption (Loon and Georgette 1989), residents from these villages have largely not registered in the subsistence hunt.

Hunter Residency and Success. Local residents, nonlocal residents and nonresidents each took approximately 1/3 of the bears reported harvested in Unit 23 (Table 6). High noncompliance with harvest reporting by local residents (Loon and Georgette 1989) makes comparison of harvests based on residency difficult to interpret.

Harvest Chronology. As in past years, a majority of the reported harvest occurred in the fall season (61–68%) (Table 7).

Transport Methods. Most hunters used aircraft to access hunting areas in the fall and snow machines during spring (Table 9). The use of ATVs in Unit 23 is increasing as guides and outfitters base ATVs at remote camps.

Other Mortality

Resident hunters killed two bears in defense of life or property (DLP) in 1996–1997, both incidents occurred at field camps in the lower Noatak drainage. Two bears were killed in 1997–1998 when they became threats to the residents of Buckland and Selawik.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

The Red Dog Mine appears to have had very little impact on bears in that area. Cominco staff remedied initial problems by improving garbage incineration procedures and facilities. Development plans call for increased staffing and production at the current lead-zinc deposit. The need for additional gravel may increase the possibility of disturbing bears near the mine.

CONCLUSIONS AND RECOMMENDATIONS

- Assist in implementing an alternative harvest reporting system that would include grizzly bears. Take advantage of opportunities to inform the public about the role of harvest data in local management programs.

- Continue to inform local residents of subsistence brown bear regulations especially in upper Kobuk villages. Also, continue to issue permits by telephone. We recommend that a current hunting license should not be a prerequisite to obtain a registration permit in the NWABBMA.

- Encourage and participate in the development of new techniques for assessing brown bear populations.

- Solicit information and observations on the distribution and numbers of bears near the Red Dog mine from the mine's environmental staff. There should be a special emphasis on identifying and protecting bear denning habitat.

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PREPARED BY:

Lee Anne Ayres
Wildlife Biologist II

SUBMITTED BY:

Peter J. Bente
Survey-Inventory Coordinator

Table 1 Reported harvest[a] of brown bears, Unit 23, 1985–1998

	Reported harvest				Non-hunting harvest			Estimated harvest
Regulatory year	M	F	Unk	Total	M	F	Unk	Total
1985-1986								
Fall 1985	7	4	2	13				
Spring 1986	7	2	0	9				
Total	14	6	2	22	1	3	1	27
1986-1987								
Fall 1986	11	9	0	20				
Spring 1987	11	2	0	13				
Total	22	11	0	33	1	2	1	37
1987-1988								
Fall 1987	12	7	1	20				
Spring 1988	3	0	0	3				
Total	15	7	1	23	0	0	0	23
1988-1989								
Fall 1988	11	4	0	15				
Spring 1989	14	4	1	19				
Total	25	8	1	34	2	0	0	36
1989-1990								
Fall 1989	9	9	2	20				
Spring 1990	10	1	0	11				
Total	19	10	2	31	2	3	0	36
1990-1991								
Fall 1990	9	10	0	19				
Spring 1991	14	3	0	17				
Total	23	13	0	36	1	1	1	39
1991-1992								
Fall 1991	10	5	1	16				
Spring 1992	15	4	0	19				
Total	25	9	1	35	1	0	0	36

Table 1 Continued

	Reported harvest				Non-hunting harvest			Estimated harvest
Regulatory year	M	F	Unk	Total	M	F	Unk	Total
1992-1993								
Fall 1992	22	12	0	34				
Spring 1993	7	0	0	7				
NWABBMA	5	2	0	7				
Total	34	14	0	48	4	1	0	53
1993-1994								
Fall 1993	15	4	0	19				
Spring 1994	12	1	0	13				
NWABBMA	2	1	1	4				
Total	29	6	1	36	1	0	1	38
1994-1995								
Fall 1994	15	7	0	22				
Spring 1995	8	0	0	8				
NWABBMA	1	0	1	2				
Total	24	7	1	32	1	0	0	33
1995-1996								
Fall 1995	18	7	0	25				
Spring 1996	5	2	0	7				
NWABBMA	4	0	2	6				
Total	27	9	2	38	1	0	0	39
1996-1997								
Fall 1996	10	6	1	17				
Spring 1997	6	1	0	7				
NWABBMA	2	1	2	5				
Total	18	8	3	29	0	1	2	32
1997-1998								
Fall 1997	11	6	0	17				
Spring 1998	8	1	0	9				
NWABBMA	2	0	0	2				
Total	21	7	0	28	2	0	1	31

[a] Includes spring and fall nonresident permit hunts.

[b] Includes DLP, research moralities, and other human-caused accidental mortality.

Table 2 Drawing hunt results for brown bear, Unit 23, Fall 1989-Spring 1998

	Hunting success of drawing permittees					Number	Permits
	Successful		Unsuccessful	Did not hunt	No report	of applicants	available
Season	*n*	(%)	*n*	*n*	*n*	*n*	*n*
1989 Fall	7	(58)	5	5	1	42	18
1990 Spring	5	(100)	0	2	0	13	7
1990 Fall	7	(58)	5	2	0	31	18
1991 Spring	6	(100)	0	1	0	15	7
1991 Fall	7	(47)	8	1	0	26	18
1992 Spring	5	(83)	1	0	0	6	6
1992 Fall	7	(64)	4	7	0	21	18
1993 Spring	2	(100)	0	4	1	11	7
1993 Fall	7	(54)	6	1	1	21	18
1994 Spring	5	(83)	1	1	0	7[a]	7
1994 Fall	4	(36)	7	4	3	23	18
1995 Spring	3	(75)	1	3	0	8	7
1995 Fall	8	(50)	8	1	1	24	18
1996 Spring	5	(83)	1	1	0	7	7
1996 Fall	7	(44)	9	1	1	38	18
1997 Spring	3	(50)	3	0	0	6[b]	7
1997 Fall	4	(31)	9	3	2	27	18
1998 Spring	3	(43)	4	0	0	7[c]	7

[a]Staff issued 2 permits over the counter.
[b]Staff issued 1 permit over the counter.
[c]Staff issued 5 permits over the counter.

Table 3 Hunter residency of permits issued for the Northwest Alaska Brown Bear Management Area subsistence registration hunt 1992–1998

Regulatory	Residency of hunters						Nr. hunters reporting	
year	Unit 21D	Unit 23	Unit 24	Unit 26A	Other	Total	Total	(%)
1992–1993	-	65	10	14	4	93	81	87%
1993–1994	-	63	9	9	6	87	73	84%
1994–1995	-	27	10	5	3	45	33	73%
1995–1996	-	52	24	1	4	81	70	86%
1996–1997	12	45	31	7	7	102	84	82%
1997–1998	16	47	29	13	5	110	86	78%

Table 4 Reported brown bear harvest for the Northwest Alaska Brown Bear Management Area subsistence registration hunt, 1992–1998

Regulatory	Sex of harvested brown bears				Harvest by Game Management Unit			
year	M	F	Unk	Total	Unit 21D	Unit 23	Unit 24	Unit 26A
1992–1993	9	3	0	12	-	10	1	1
1993–1994	6	0	1	7	-	4	2	1
1994–1995	1	0	1	2	-	2	0	0
1995–1996	5	0	2	7	-	6	0	1
1996–1997	5	1	0	6	-	5	1	0
1997–1998	2	0	4	6	3	2	0	1

Table 5 Monthly harvest of brown bears in the Northwest Alaska Brown Bear Management Area subsistence registration hunt, 1992–1998

Regulatory year	Number of brown bears harvested										
	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Unk	Total
1992–1993	5	1	-	-	-	-	1	5	-	-	12
1993–1994	1	1	-	-	-	-	-	4	1	-	7
1994–1995	-	-	-	-	-	-	-	2	-	-	2
1995–1996	2	1		1				2	1	-	7
1996–1997	3	1	-	-	-	-	-	2	-	-	6
1997–1998	3	-	-	-	-	-	-	2		1	6

Table 6 Brown bear harvest[a] by hunter residency, Unit 23, 1985–1998

Regulatory year	Unit 23 resident	Nonlocal resident	Nonresident	Total
1985–1986	8	5	11	24
1986–1987	6	12	15	33
1987–1988	4	10	9	23
1988–1989	17	8	9	34
1989–1990	9	9	13	31
1990–1991	12	11	13	36
1991–1992	9	14	12	35
1992–1993	12	27	9	48
1993–1994	10	14	12	36
1994–1995	10	15	7	32
1995–1996	10	16	8	34
1996–1997	10	9	10	29
1997–1998	11	9	8	28

[a] Includes nonresident permit hunts and excludes non-hunting mortalities.

Table 7 Monthly harvest of brown bears, Unit 23, 1986–1998

Regulatory	August		September		October		April		May		Other		
year	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	Total
1986–1987	-	-	20	(61)	0	(0)	8	(24)	5	(15)			33
1987–1988	-	-	17	(74)	3	(13)	1	(4)	3	(9)	-	-	23
1988–1989	-	-	13	(38)	2	(6)	12	(35)	7	(21)	-	-	34
1989–1990	1	(3)	16	(52)	3	(10)	7	(23)	4	(13)	-	-	31
1990–1991	-	-	18	(50)	1	(3)	14	(39)	3	(8)	-	-	36
1991–1992	-	-	15	(43)	1	(3)	16	(46)	3	(8)	-	-	35
1992–1993	-	-	34	(71)	2	(4)	12	(25)	0	(0)	-	-	48
1993–1994	-	-	19	(53)	0	(0)	14	(39)	3	(8)	-	-	36
1994–1995	-	-	21	(66)	1	(3)	6	(19)	4	(12)	-	-	32
1995–1996	-	-	24	(70)	1	(3)	5	(15)	3	(9)	1[b]	(3)	34
1996–1997	-	-	19	(65)	1	(3)	7	(24)	2	(7)	-	-	29
1997–1998	-	-	16	(57)	1	(4)	9	(32)	2	(8)	-	-	28

[a] Excludes non-hunting mortalities.
[b] Harvested in December.

Table 8 Reported brown bear harvest by drainage, Unit 23, 1996–1998

Regulatory year	Noatak	Wulik	Lower Kobuk	Upper Kobuk	Selawik	Northern Seward	Total
1996–1997							
Fall	13	-	2	2	1	2	20
Spring	4	-	4	-	-	1	9
1997–1998							
Fall	10	2	1	2	1	1	17
Spring	7	1	-	1	-	3	12

Table 9 Reported brown bear harvest by transport method, Unit 23, 1985–1998

Regulatory year	Airplane	Boat	4-wheeler/ ORV	Snowmachine	Other	Unknown	Total
1985–1986	16	1	1	6	-	-	24
1986–1987	19	7	-	5	1	1	33
1987–1988	17	4	2	-	-	-	23
1988–1989	13	3	7	11	-	-	34
1989–1990	21	3	1	6	-	-	31
1990–1991	23	5	1	7	-	-	36
1991–1992	21	2	-	12	-	-	35
1992–1993	32	2	6	6	-	2	48
1993–1994	23	1	1	11	-	-	36
1994–1995	16	7	1	7	1	-	32
1995–1996	20[a]	5[b]	2	7	-	-	34
1996–1997	13	9	1	6	-	-	29
1997–1998	16	6	-	6	-	-	28

[a] One hunter indicated he used a boat in conjunction with an airplane, 2 hunters indicated they used
4-wheeler's in conjunction with an airplane.
[b] Three hunters used both a boat and 4-wheeler to harvest brown bears.

LOCATION

GAME MANAGEMENT UNIT: 24 (26,092 mi^2)

GEOGRAPHIC DESCRIPTION: Koyukuk River drainage upstream from the Dulbi River

BACKGROUND

Grizzly bears are in moderate numbers throughout Unit 24, with the highest densities in the mountainous areas near the Brooks Range in the northern portion of the unit. Specific data on grizzly bear populations in Unit 24 is limited. Information from studies conducted on the northern slopes of the Brooks Range in Unit 26 (Crook 1972; Reynolds 1976; Reynolds and Hechtel 1984), or in the southwestern Brooks Range in Unit 23 (Ballard et al. 1988) has been used to describe bear populations in Unit 24.

The reported harvest since 1961 rarely exceeded 15–20 grizzly bears/year. An exception was in the early 1970's when bear hunting on the Alaska Peninsula was closed on an alternate-year basis, resulting in increased bear hunting pressure over the rest of the state. The annual harvest of bears in Unit 24 reached a maximum of 31 during that period. To prevent over-harvest, a drawing permit system was in place during 1977–1985.

Previous reports indicate bear populations are stable or may be slowly increasing (Woolington 1997). Local hunters (residents of Unit 24) take very few bears, and although the opening of the Dalton Highway to the public increased the number of potential nonlocal hunters, an increase in harvest has not occurred. Historically, grizzly bears were an important source of food and hides for local people. However, with the exception of Anaktuvuk Pass residents, recent hunting effort for grizzly bears by unit residents has declined.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Protect, maintain, and enhance the grizzly bear population and its habitat in concert with other components of the ecosystem.

MANAGEMENT OBJECTIVES

- Mange a grizzly bear population that will sustain a minimum annual harvest of 20 bears in the northern portion of the unit and a minimum harvest of 15 bears in the remainder of the unit.

- Reduce nuisance bear complaints, increase sealing compliance, and reduce the unreported harvest of bears in the unit.

- Work with U.S. National Park Service and U.S. Fish and Wildlife Service to determine bear density throughout the unit.

METHODS

We monitored harvest through sealing requirements and returns from hunters reporting under the Northwest Alaska Brown Bear Management Area permit regulations. Data collected during sealing included sex, location of harvest, skull measurements, and age if teeth were submitted for aging. Data specific to harvest such as transportation methods, time of harvest, and commercial services utilized were also recorded. Data collected from bears harvested under permit regulations were limited to sex, location, and date of harvest. Harvest data were summarized by regulatory year (RY = 1 July–30 June). Bear/human conflicts were addressed through education, legal harvest of problem bears, and changes in regulations.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The grizzly bear population in Unit 24 was likely stable or slowly increasing based on field observations, nuisance reports, and hunter sightings of bears during the past 10 years. However, no surveys were conducted in the area during the reporting period.

Reynolds (1989) estimated densities of 33 bears/1000 mi^2 within Gates of the Arctic National Park (7000 mi^2), 33/1000 mi^2 outside the Park but still within the Brooks Range (6,500 mi^2), and 22–33 bears/1000 mi^2 in the remainder of Unit 24 to the south (14,500 mi^2). He estimated 450 bears in northern Unit 24 (North of Allakaket) and 320–480 in the remainder of the unit (South of Allakaket). Earlier work in similar habitats in interior and arctic Alaska provided a basis for these estimates (Reynolds 1976, Reynolds and Hechtel 1984).

MORTALITY

Harvest

Seasons and Bag Limits.

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts	Nonresident Open Season
Unit 24		
One bear every regulatory year by registration permit.	1 Sep–31 May (Subsistence hunt only)	No open season
One bear every 4 regulatory years.	1 Sep–31 May	1 Sep–31 May

Board of Game Actions and Emergency Orders. In 1990, the board eliminated all requirements for drawing permits and made the season uniform throughout the unit. The season in Unit 24 was also aligned with seasons in Units 19, 20, and 21. In 1992, the board established the Northwest Alaska Brown Bear Management Area that included portions of the

unit west of the Dalton Highway Corridor Management Area. The season length remained the same, but the bag limit changed to 1 bear/year. Also, all meat had to be salvaged, sealing requirements were waived if the hide and skull remained within the management area, there was no resident tag fee, and aircraft could not be used. During the spring 1996 Board of Game meeting, the portion of Unit 24 within the Dalton Highway Management Corridor Management Area was included within the Northwest Alaska Brown Bear Management Area. This action allowed those unit residents that resided within the corridor to participate in the subsistence hunt and transport the bear hides to their residence without sealing.

Hunter Harvest. The average annual harvest of bears by hunters from fall 1992 through spring 1998 was 12.2 bears (Table 1). The reported three-year average harvest (RY 1996-1997 through 1997–1998) for the northern (north of Allakaket) and southern (remaining) portions of the unit was 10.7 and 1.3 bears, respectively. The number of bears taken by fisherman or by trappers and not reported is unknown, but it was likely <4 bears annually. The 5-year mean annual reported and estimated unreported harvest (RY 1993–1994 through 1998–1999) for the entire unit was 17 bears. Of the reported harvest for that same period, 61% were males and 39% were females. Based on the estimated sustainable harvest rate of 5–6% in other areas of Interior Alaska (Dubois 1989), a harvest of 39–47 bears can be sustained in this unit.

Hunter Residency and Success. Residents of Alaska who did not live in Unit 24 accounted for most of the reported harvest (Table 2). Most of this harvest was incidental to fall moose hunting. Nonresident and local residents took very few bears. There were 8–17 successful hunters each year over the past 6 regulatory years for the three groups of hunters.

Harvest Chronology and Transport Methods. Most kills occurred during the fall (84%) incidental to the harvest of other game species. Over the past 6 regulatory years, transportation to the hunt area was primarily by airplane (31%), highway vehicle (27%), or boat (20%).

CONCLUSIONS AND RECOMMENDATIONS

The objective of maintaining a population that can sustain a harvest of 20 bears in the northern portion of the unit and 15 bears in the southern portion of the unit was achieved. During the reporting period, the harvest throughout the unit was very low and was not an influencing factor on the population.

Although some localized over-hunting could occur in Unit 24, the grizzly bear population as a whole is probably not susceptible to over-harvest because hunting is restricted within the Gates of the Arctic National Park that includes much of the brown bear habitat in the unit. Much of the rest of the unit is more heavily forested and difficult to hunt. Also, hunting with firearms is prohibited within 5 miles of the Dalton Highway.

The objective to reduce nuisance bear complaints, increase sealing compliance and reduce the unreported harvest was partially achieved as a result of data collected through the Northwest Alaska Brown Bear Management Area harvest reporting system. No education efforts were completed during the reporting period, but that activity will be emphasized in the future. Additionally, no progress was made regarding the objective of determining bear density

through coordination with federal agencies.

The harvest management objectives for the next reporting period will be changed. The new management objective will be:

- Manage a grizzly population that will sustain a three-year mean annual reported harvest of at least 20 bears in the northern portion of the Unit (north of Allakaket) and at least 15 bears in the southern (remaining) portion of the Unit, with at least 50% males in the reported harvest.

Education, improved reporting compliance, and federal agency cooperative activities will continue to be given high priority during the next reporting period, but they will not be considered management objectives. Age and sex ratios of harvested animals are the standard for monitoring large predator populations in the absence of intensive population investigations.

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PREPARED BY:

Glenn W Stout
Wildlife Biologist II

SUBMITTED BY:

Roy A Nowlin
Assistant Management Coordinator

REVIEWED BY:

Harry V Reynolds, III
Wildlife Biologist III

Table 1 Unit 24 grizzly bear harvest, regulatory year 1992–1993 through fall 1998

Regulatory year	Reported								Estimated kill		Total estimated kill			
	Hunter kill				Nonhunting kill[a]									
	M	F	Unk	Total	M	F	Unk	Total	Unreported	Illegal	M	F	Unk	Total
1992–1993														
Fall 1992	7	6	0	13	0	0	1	1	3	2	7	6	6	19
Spring 1993	4	0	0	4	0	0	0	0	0	0	4	0	0	4
Total	11	6	0	17	0	0	1	1	3	2	11	6	6	23
1993–1994														
Fall 1993	5	0	0	5	0	0	1	1	3	2	5	0	6	11
Spring 1994	3	0	0	3	1	0	0	1	0	0	4	0	0	4
Total	8	0	0	8	1	0	1	2	3	0	9	0	6	15
1994–1995														
Fall 1994	6	8	0	14	0	0	0	0	3	2	6	8	5	19
Spring 1995	1	1	0	2	0	0	0	0	0	0	1	1	0	2
Total	7	9	0	16	0	0	0	0	3	2	7	9	5	21
1995–1996														
Fall 1995	4	4	0	8	0	1	0	1	3	2	4	5	5	14
Spring 1996	0	1	0	1	0	0	0	0	0	0	0	1	0	1
Total	4	5	0	9	0	1	0	1	3	2	4	6	5	15
1996–1997														
Fall 1996	9	4	0	13	0	0	0	0	3	2	9	4	5	18
Spring 1997	1	1	0	2	0	0	0	0	0	0	1	1	0	2
Total	10	5	0	15	0	0	0	0	3	2	10	5	5	20
1997–1998														
Fall 1997	6	2	0	8	0	1	0	1	3	2	6	3	5	14
Spring 1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	6	2	0	8	0	1	0	1	3	2	6	3	5	14
1998–1999														
Fall 1998	7	6	0	13	2	0	0	2	3	2	9	6	5	20

Table 2 Unit 24 grizzly bear successful hunter residency, regulatory year 1992–1993 through fall 1998

Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Total successful hunters
1992–1993	3	9	5	17
1993–1994	1	5	2	8
1994–1995	1	11	4	16
1995–1996	1	7	1	9
1996–1997	2	7	6	15
1997–1998	0	4	4	8
Fall 1998	0	9	4	13

[a] Unit residents.

LOCATION

GAME MANAGEMENT UNITS: 25A, 25B, 25D, 26B, and 26C (73,755 mi^2)

GEOGRAPHIC DESCRIPTION: Eastern North Slope of the Brooks Range and the upper Yukon River Drainage

BACKGROUND

Conservative management followed a decline in brown bear numbers during the 1960s, resulting primarily from aircraft-supported hunting associated with guiding. Units 26B and 26C were closed to brown bear hunting in regulatory year 1971–1972. In subsequent years a variety of regulations were used to limit harvest and increase brown bear numbers. Regulations have been gradually liberalized as populations recovered. A harvest objective that does not exceed 5% of estimated populations has been used in recent years.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Protect, maintain, and enhance brown bear populations and habitat in concert with other components of the ecosystem.
- Provide the opportunity to hunt brown bears under aesthetically pleasing conditions in the eastern Brooks Range.
- Provide the greatest sustained opportunity to participate in hunting brown bears in the upper Yukon and Porcupine drainages.

MANAGEMENT OBJECTIVES

- In Unit 25, maintain a brown bear population capable of sustaining mean annual harvests of 29 bears in Unit 25A and 29 bears in Units 25B and 25D, with a minimum of 60% males in the harvest.
- In Units 26B and 26C, maintain a brown bear population capable of sustaining a mean annual hunter harvest of 13 bears in Unit 26B and 19 bears in 26C, with a minimum of 60% males in the harvest.

METHODS

Brown bear population density estimates for Units 25A, 25B, 25D, 26B, and 26C were revised in 1993 based on studies done in parts of these areas (Reynolds 1976; Garner et al. 1984; Reynolds and Hechtel 1984) or in similar habitat elsewhere (Reynolds 1992), taking into consideration observations by area residents and others with a long-term familiarity with the area. Harvest data are obtained from mandatory sealing documents. Harvest data were summarized by regulatory year (RY = 1 July–30 June).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Conservative regulations, including a drawing permit system that was in use from 1977 until recently, fostered a recovery in the number of brown bears in Units 25A, 26B, and 26C. Bear numbers in Unit 25A were likely stable or increasing. The trend in Units 26B and 26C was likely stable. The long-term population trend in Units 25B and 25D was less well known, but brown bears were common throughout the area and numbers were probably stable or increasing. North Slope residents reported that brown bears were abundant compared to historic levels. Similarly, residents of the Yukon Flats reported that brown bears were relatively scarce during much of this century but were abundant during this reporting period. Numbers in this area increased in the last 10–20 years, probably because of a decline in the number of bears harvested by local residents.

Population Size

We revised population estimates in 1993 and have since used those estimates in our management program (Table 1). The revision was part of a statewide effort to update brown bear population information. We based our estimates on extrapolation from studies in the area or in similar habitat (Reynolds 1976, 1992; Reynolds and Hechtel 1984; Reynolds and Garner 1987), field observations on bear abundance and population trend, and more accurate calculations of land area based on computer digitization of game management units.

Current estimates of bear numbers are somewhat higher than estimates made prior to 1993, largely because increased knowledge of bear densities and, to a lesser extent, because previous calculations of land area were lower than current measurements. We estimated there were 1817 brown bears in the eastern Brooks Range and upper Yukon River drainage.

Distribution and Movements

Brown bears are distributed throughout the area. Densities were generally highest in the foothills of the Brooks Range and lowest on the coastal plain of the North Slope. An artificially high concentration of bears developed near Prudhoe Bay (23 in 1500 mi^2; R Shideler, personal communication) because discarded food is available in dumpsters and in the Prudhoe Bay landfill.). We observed movement of some brown bears from the mountains to the Porcupine caribou herd calving area on the coastal plain. Brown bears are also known to concentrate near salmon spawning areas on the Sheenjek River in Unit 25A.

MORTALITY

Season and Bag Limit.

Units and Bag Limits	Resident Open Season	Nonresident Open Season
Unit 25A		
RESIDENT AND NONRESIDENT HUNTERS:		
One bear every 4 regulatory years.	1 Sep–20 May	1 Sep–20 May

Units and Bag Limits	Resident Open Season	Nonresident Open Season
Units 25B and 25D (RY 1996–1997 and 1997–1998)..		
RESIDENT AND NONRESIDENT HUNTERS: One bear every 4 regulatory years.	1 Sep–31 May	1 Sep–31 May
Unit 25D (RY 1998–1999).		
RESIDENT AND NONRESIDENT HUNTERS: One bear every regulatory year.	1 Sep–31 May	1 Sep–31 May
Unit 26B (RY 1996–1997 and 1997–1998).		
RESIDENT AND NONRESIDENT HUNTERS: One bear every 4 regulatory years.	20 Aug–31 May	20 Aug–31 May
Unit 26B. (RY 1998–1999).		
RESIDENT HUNTERS: One bear every 4 regulatory years.	1 Sep–31 May	
NONRESIDENT HUNTERS: One bear every 4 regulatory years by drawing permit only; up to 10 permits will be issued.		1 Sep–20 May
Unit 26C.		
RESIDENT AND NONRESIDENT HUNTERS: One bear every 4 regulatory years.	20 Aug–31 May	20 Aug–31 May

Board of Game Actions and Emergency Orders. Regulatory actions during this reporting period included an emergency order that closed the spring 1998 brown bear season in Unit 26B and board actions that reinstated a drawing hunt for nonresidents and changed the season opening date from 20 August to 1 September in this unit. The board also liberalized brown bear hunting regulations in Unit 25D, eliminating the tag fee for resident hunters and establishing a bag limit of 1 bear per year. These regulations took effect in RY 1998–1999. We supported them because harvests in the area were extremely low and less restrictive regulations could provide for additional hunting opportunity. The estimated sustainable harvest in Unit 25D was 19 bears, whereas the reported annual harvest was <5 bears.

Drawing permits were required for all brown bear hunters in Units 25A, 26B, and 26C beginning in RY 1977–1978. As bear populations recovered, regulatory changes included applying the permit requirement only to nonresidents and increasing the number of permits issued in some areas. The requirement for a drawing permit for nonresidents only was applied in Units 25A and 26C beginning in RY 1984–1985, and in Unit 26B beginning in RY 1987–1988.

The need for the nonresident permit system in Units 25A, 26B, and 26C was reevaluated in 1993. The improved status of bear populations, a low level of harvest relative to a

conservative estimate of sustainable harvest, and the cumbersome nature of the permit system prompted the department to propose eliminating the drawing permit system for nonresident hunters in Units 25A and 26C. The Board of Game adopted this proposal in March 1994, with the understanding that harvests would be closely monitored and that the average annual harvest in each unit during a 2-year period should not exceed the estimated sustainable harvest (Table 1).

Similarly, the permit system for nonresidents in Unit 26B was reevaluated and eliminated by the Board of Game beginning in RY 1996–1997. The board also established an earlier season opening date of 20 August in Units 26B and 26C. This occurred in response to the closure of the September hunting season for moose in most of Unit 26 that took effect in RY 1996–1997. A decline in brown bear harvest during September was expected to result from the decline in hunting activity during this period.

The new regulations that eliminated drawing permits were established with the support of guides, and with the understanding that guides and ADF&G would work together to keep harvests within sustainable limits and selectively harvest male bears. These regulations worked as intended in Units 25A and 26C, but resulted in an unacceptable increase in the harvest in Unit 26B. Following the harvest of 25 bears in RY 1996–1997, and 25 in fall 1997, the department closed the remainder of the RY 1997–1998 season by emergency order. A department proposal to restore a drawing permit hunt for nonresident hunters and open the season on 1 September rather than 1 August was passed by the board in March 1998. However, in view of the high harvests during the previous 2 years, no permits were issued for RY 1998–1999. The regulation change substantially reduced brown bear harvest. Only 4 bears were reported taken in fall 1998. Up to 3 drawing permits were issued for nonresident hunters for RY 1999–2000, with a 1 September–31 October open season.

Hunter Harvest. The total annual hunter harvest during RY 1989–1990 through 1997–1998 was 29–57 (Tables 2–5). Most were taken in Units 25A, 26B and 26C. The overall harvest was nearly stable in recent years, except in Unit 26B where the number of bears taken increased during this reporting period. Increased bear numbers and a gradual liberalization of regulations resulted in harvests that were higher than during the late 1970s and early 1980s but were still below the estimated allowable take of 5%, except in Unit 26B.

The only unit in which harvests approached or exceeded the allowable kill was Unit 26B, where 25 bears were harvested in RY 1996–1997 and again the following year. These harvests represented an increase from the take of 11–17 bears during the previous 6 years (Table 4) and substantially exceeded the Unit 26B harvest objective of 13 bears (Table 1). Reports from hunters and casual observations indicated that bears were still common in Unit 26B. However, access and hunting pressure adjacent to the Dalton Highway indicate the situation should be closely monitored.

The proportion of males in the overall harvest was 61% in RY 1996–1997 and 66% in RY 1997–1998 (Tables 2–5). The number of female bears taken in Units 25, 26B, and 26C during this reporting period was relatively low. Most bears were taken during fall hunts.

Permit Hunts. There were no permit hunts in effect during this reporting period. During RY 1994–1995 and RY 1995–1996, drawing permits were required for nonresident hunters in Unit 26B, but not for Alaska residents. Harvest by permit holders in RY 1994–1995 and RY 1995–1996 was 3 and 5, compared with a total hunter harvest in the permit areas of 12 and 11, respectively (Table 6). Most bears were taken during fall hunts.

Hunter Residency and Success. Residents of Alaska accounted for 34% and 33% of the successful hunters during the RY 1996–1997 and RY 1997–1998 seasons, respectively, in Units 25A, 25B, 25D, 26B, and 26C (Tables 7–10). Only a few local residents reported taking bears. These figures probably underrepresented the number taken by local hunters, particularly in Units 25A, 25B and 25D, where a few additional bears are taken but not sealed.

Transport Methods. Most brown bears were harvested during aircraft-supported hunts, with a few taken by hunters using snowmachines and boats. Highway vehicles provided access for some hunters near the Dalton Highway.

Other Mortality

The number of brown bears taken and not reported was unknown, but there were occasional reports of bears being killed but not sealed, especially near villages in Unit 25. Some of this harvest probably occurred in defense of life or property incidents. Local residents of this area do not often specifically hunt bears, but commonly encounter them in the course of other activities. Continued efforts to encourage local residents to report harvest and seal bears are necessary.

Relatively little is known about natural mortality of brown bears in northeastern Alaska. Reynolds and Hechtel (1984) observed natural mortality rates in the western Brooks Range of 47% for cubs, 12% for yearlings, and 13% for 2-year-olds.

CONCLUSIONS AND RECOMMENDATIONS

Management objectives were generally met in the area, and harvests in Units 25A, 25B, 25D, and 26C were at or below levels specified in management objectives. The elimination of nonresident drawing permits in Units 25A and 26C has not resulted in an appreciable increase in harvest. However, the allowable harvest of 13 bears in Unit 26B was exceeded in each of the last 2 years. Regulatory changes that took effect in RY 1998–1999 should significantly reduce brown bear harvest in Unit 26B.

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PREPARED BY:

Robert O Stephenson
Wildlife Biologist III

SUBMITTED BY:

Roy A Nowlin
Regional Management Assistant

REVIEWED BY:

Harry V Reynolds, III
Wildlife Biologist III

Table 1 Units 25A, 25B, 25D, 26B, and 26C brown bear population parameters and estimated sustainable harvest, 1993–1998

Unit	Area (mi^2)	Estimated density/100 mi^2	Estimated population size	Allowable harvest @ 5%
25A	21,280	2.8	584	29
25B and D	26,660	2.2	580	29
25 subtotal	47,940		1164	58
26B	15,500	1.7	262	13
26C	10,272	3.8	391	19
26 subtotal	25,772		653	32
Total	73,712	2.5	1817	90

Table 2 Unit 25A brown bear harvest[ab], regulatory years 1989–1990 through 1997–1998

Regulatory year	Reported								Total estimated kill				
	Hunter kill					Nonhunting kill[c]							
	M	F	(%)	Unk	Total	M	F	Unk	M	(%)	F	(%)	Unk	Total
1989–1990														
Fall 1989	6	6	(50)	0	12	1	1	1	7	(47)	7	(47)	1	15
Spring 1990	0	0	(0)	0	0	0	0	0	0	(0)	0	(0)	0	0
Total	6	6	(50)	0	12	1	1	1	7	(47)	7	(47)	1	15
1990–1991														
Fall 1990	6	3	(33)	0	9	0	0	0	6	(66)	3	(33)	0	9
Spring 1991	3	2	(40)	0	5	0	0	0	3	(60)	2	(40)	0	5
Total	9	5	(36)	0	14	0	0	0	9	(64)	5	(36)	0	14
1991–1992														
Fall 1991	7	3	(30)	2	12	0	0	0	7	(70)	3	(30)	2	12
Spring 1992	3	0	(0)	0	3	0	0	0	3	(100)	0	(0)	0	3
Total	10	3	(30)	2	15	0	0	0	10	(77)	3	(23)	2	15
1992–1993														
Fall 1992	11	5	(31)	0	16	1	0	0	12	(71)	5	(29)	0	17
Spring 1993	0	0	(0)	0	0	0	0	0	0	(0)	0	(0)	0	0
Total	11	5	(31)	0	16	1	0	0	12	(71)	5	(29)	0	17
1993–1994														
Fall 1993	5	3	(38)	0	8	0	0	0	5	(62)	3	(38)	0	8
Spring 1994	0	0	(0)	0	0	0	0	0	0	(0)	0	(0)	0	0
Total	5	3	(38)	0	8	0	0	0	5	(62)	3	(38)	0	8
1994–1995														
Fall 1994	9	3	(25)		12	0	0	0	9	(75)	3	(25)	0	12
Spring 1995	0	1	(100)		1	0	0	0	0	(0)	1	(100)	0	1
Total	9	4	(31)		13	0	0	0	9	(69)	4	(31)	0	13

Regulatory year	Reported								Total estimated kill					
	Hunter kill					Nonhunting kill[c]								
	M	F	(%)	Unk	Total	M	F	Unk	M	(%)	F	(%)	Unk	Total
1995–1996														
Fall 1995	10	4	(29)		14	0	0	0	10	(71)	4	(29)	0	14
Spring 1996	0	0	(0)		0	0	0	0	0	(0)	0	(0)	0	0
Total	10	4	(29)		14	0	0	0	10	(71)	4	(29)	0	14
1996–1997														
Fall 1996	11	9	(45)		20	0	0	0	11	(55)	9	(45)	0	20
Spring 1997	0	0	(0)		0	0	0	0	0	(0)	0	(0)	0	0
Total	11	9	(45)		20	0	0	0	11	(55)	9	(45)	0	20
1997–1998														
Fall 1997	6	5	(45)		11	1	0	0	7	(58)	5	(42)	0	12
Spring 1998	0	1	(100)		1	0	0	0	0	(0)	1	(100)	0	1
Total	6	6	(45)		12	1	0	0	7	(58)	6	(42)	0	13

[a] Includes permit harvest.

[b] No estimate was made of unreported or illegal kills.

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

Table 3 Unit 25B and 25D brown bear harvest[ab], regulatory years 1989–1990 through 1997–1998

Regulatory year	Reported								Total estimated kill					
	Hunter kill					Nonhunting kill[c]								
	M	F	(%)	Unk	Total	M	F	Unk	M	(%)	F	(%)	Unk	Total
1989–1990														
Fall 1989	1	1	(50)	0	2	0	0	0	1	(50)	1	(50)	0	2
Spring 1990	3	0	(0)	0	3	0	0	0	3	(100)	0	(0)	0	3
Total	4	1	(20)	0	5	0	0	0	4	(80)	1	(20)	0	5
1990–1991														
Fall 1990	1	2	(66)	0	3	0	0	0	1	(33)	2	(66)	0	3
Spring 1991	1	1	(50)	0	2	0	0	0	1	(50)	1	(50)	0	2
Total	2	3	(60)	0	5	0	0	0	2	(40)	3	(60)	0	5
1991–1992														
Fall 1991	1	0	(0)	0	1	0	0	0	1	(100)	0	(0)	0	1
Spring 1992	0	1	(100)	0	0	0	0	0	0	(0)	1	(100)	0	0
Total	1	1	(50)	0	2	0	0	0	1	(50)	1	(50)	0	2
1992–1993														
Fall 1992	1	0	(0)	0	1	0	0	0	1	(100)	0	(0)	0	1
Spring 1993	2	1	(33)	0	3	0	0	0	2	(66)	1	(33)	0	3
Total	3	1	(25)	0	4	0	0	0	3	(75)	1	(25)	0	4
1993–1994														
Fall 1993	2	0	(0)	0	2	0	0	0	2	(100)	0	(0)	0	2
Spring 1994	0	0	(0)	0	0	0	0	0	0	(0)	0	(0)	0	0
Total	2	0	(0)	0	2	0	0	0	2	(100)	0	(0)	0	2
1994–1995														
Fall 1994	2	0	(0)	0	2	0	0	0	2	(100)	0	(0)	0	2
Spring 1995	1	1	(50)	0	2	0	0	0	1	(50)	1	(50)	0	2
Total	3	1	(25)	0	4	0	0	0	3	(75)	1	(25)	0	4
1995–1996														

Regulatory year	Reported								Total estimated kill				
	Hunter kill					Nonhunting kill[c]							
	M	F	(%)	Unk	Total	M	F	Unk	M	(%)	F	(%)	Unk	Total
Fall 1995	1	0	(0)	0	1	0	0	0	1	(100)	0	(0)	0	1
Spring 1996	1	0	(0)	0	1	0	0	0	1	(100)	0	(0)	0	1
Total	2	0	(0)	0	2	0	0	0	2	(100)	0	(0)	0	2
1996–1997														
Fall 1996	3	1	(25)	0	4	0	0	0	3	(75)	1	(25)	0	4
Spring 1997	0	0	(0)	0	0	0	0	0	0	(0)	0	(0)	0	0
Total	3	1	(25)	0	4	0	0	0	3	(75)	1	(25)	0	4
1997–1998														
Fall 1997	0	0	(0)	0	0	0	0	0	0	(0)	0	(0)	0	0
Spring 1998	0	0	(0)	0	0	0	0	0	0	(0)	0	(0)	0	0
Total	0	0	(0)	0	0	0	0	0	0	(0)	0	(0)	0	0

[a] Includes permit harvest.

[b] No estimate was made of unreported or illegal kills.

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

Table 4 Unit 26B brown bear harvest[ab], regulatory years 1989–1990 through 1997–1998

Regulatory year	Reported								Total estimated kill				
	Hunter kill					Nonhunting kill[c]							
	M	F	(%)	Unk	Total	M	F	Unk	M	(%)	F	(%)	Unk	Total
1989–1990														
Fall 1989	6	5	(45)	0	11	1	0	0	7	(58)	5	(42)	0	12
Spring 1990	3	1	(25)	0	4	0	0	0	3	(75)	1	(25)	0	4
Total	9	6	(40)	0	15	1	0	0	10	(63)	6	(37)	0	16
1990–1991														
Fall 1990	3	5	(62)	0	8	0	0	0	3	(38)	5	(62)	0	8
Spring 1991	4	0	(0)	0	4	0	0	0	4	(100)	0	(0)	0	4
Total	7	5	(42)	0	12	0	0	0	7	(58)	5	(42)	0	12
1991–1992														
Fall 1991	8	5	(38)	0	13	0	0	0	8	(62)	5	(38)	0	13
Spring 1992	4	0	(0)	0	4	0	0	0	4	(100)	0	(0)	0	4
Total	12	5	(29)	0	17	0	0	0	12	(71)	5	(29)	0	17
1992–1993														
Fall 1992	7	4	(36)	0	11	0	1	0	7	(58)	5	(42)	0	12
Spring 1993	1	1	(33)	1	3	0	0	0	1	(33)	1	(33)	1	3
Total	8	5	(36)	1	14	0	1	0	8	(53)	6	(40)	1	15
1993–1994														
Fall 1993	4	5	(56)	1	10	0	1	0	4	(36)	6	(55)	1	11
Spring 1994	1	1	(50)	0	2	0	0	0	1	(50)	1	(50)	0	2
Total	5	6	(55)	1	12	0	1	0	5	(38)	7	(54)	1	13
1994–1995														
Fall 1994	6	4	(40)	0	10	0	0	0	6	(60)	4	(40)	0	10
Spring 1995	2	0	(0)	0	2	0	0	0	2	(100)	0	(0)	0	2
Total	8	4	(33)	0	12	0	0	0	8	(66)	4	(33)	0	12
1995–1996														

Regulatory year	Reported								Total estimated kill				
	Hunter kill					Nonhunting kill[c]							
	M	F	(%)	Unk	Total	M	F	Unk	M	(%)	F	(%)	Unk	Total
Fall 1995	7	2	(22)	0	9	0	0	0	7	(78)	2	(22)	0	9
Spring 1996	0	2	(100)	0	2	0	0	0	0	(0)	2	(100)	0	2
Total	7	4	(36)	0	11	0	0	0	7	(64)	4	(36)	0	11
1996–1997														
Fall 1996	15	7	(32)	0	22	1	0	0	16	(70)	7	(30)	0	23
Spring 1997	1	2	(66)	0	3	0	0	0	1	(33)	2	(66)	0	3
Total	16	9	(36)	0	25	1	0	0	17	(65)	9	(35)	0	26
1997–1998														
Fall 1997	17	8	(32)	0	25	0	1	0	17	(65)	9	(35)	0	26
Spring 1998	0	0	(0)	0	0	0	0	0	0	(0)	0	(0)	0	0
Total	17	8	(32)	0	25	0	1	0	17	(65)	9	(35)	0	26

[a] Includes permit harvest.

[b] No estimate was made of unreported or illegal kills.

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

Table 5 Unit 26C brown bear harvest[ab], regulatory years 1989–1990 through 1997–1998

Regulatory year	Reported								Total estimated kill				
	Hunter kill					Nonhunting kill[c]							
	M	F	(%)	Unk	Total	M	F	Unk	M	(%)	F	(%)	Unk	Total
1989–1990														
Fall 1989	1	1	(50)	0	2	1	0	0	2	(67)	1	(33)	0	3
Spring 1990	0	0	(0)	0	0	0	1	0	0	(0)	1	(100)	0	1
Total	1	1	(50)	0	2	1	1	0	2	(50)	2	(50)	0	4
1990–1991														
Fall 1990	3	1	(25)	0	4	0	0	0	3	(75)	1	(25)	0	4
Spring 1991	2	0	(0)	0	2	0	0	0	2	(100)	0	(0)	0	2
Total	5	1	(20)	0	6	0	0	0	5	(80)	1	(20)	0	6
1991–1992														
Fall 1991	4	2	(30)	0	6	2	0	2	6	(75)	2	(25)	2	10
Spring 1992	1	1	(50)	0	2	0	0	0	1	(50)	1	(50)	0	2
Total	5	3	(36)	0	8	2	0	2	7	(70)	3	(30)	2	12
1992–1993														
Fall 1992	0	5	(100)	0	5	0	0	0	0	(0)	5	(100)	0	5
Spring 1993	1	0	(0)	0	1	0	0	0	1	(100)	0	(0)	0	1
Total	1	5	(83)	0	6	0	0	0	1	(17)	5	(83)	0	6
1993–1994														
Fall 1993	6	0	(0)	0	6	0	0	0	6	(100)	0	(0)	0	6
Spring 1994	0	1	(100)	0	1	0	0	0	0	(0)	1	(100)	0	1
Total	6	1	(14)	0	7	0	0	0	6	(86)	1	(14)	0	7
1994–1995														
Fall 1994	1	2	(67)	0	3	0	0	0	1	(33)	2	(67)	0	3
Spring 1995	1	0	(0)	0	1	0	0	0	1	(100)	0	(0)	0	1
Total	2	2	(50)	0	4	0	0	0	2	(50)	2	(50)	0	4
1995–1996														

Regulatory year	Reported								Total estimated kill				
	Hunter kill					Nonhunting kill[c]							
	M	F	(%)	Unk	Total	M	F	Unk	M	(%)	F	(%)	Unk	Total
Fall 1995	4	3	(43)	0	7	0	0	0	4	(57)	3	(43)	0	7
Spring 1996	0	0	(0)	0	0	0	0	0	0	(0)	0	(0)	0	0
Total	4	3	(43)	0	7	0	0	0	4	(57)	3	(43)	0	7
1996–1997														
Fall 1996	5	3	(38)	0	8	0	0	0	5	(63)	3	(38)	0	8
Spring 1997	0	0	(0)	0	0	0	0	0	0	(0)	0	(0)	0	0
Total	5	3	(38)	0	8	0	0	0	5	(63)	3	(38)	0	8
1997–1998														
Fall 1997	4	2	(33)	0	6	0	0	0	4	(66)	2	(33)		6
Spring 1998	2	0	(0)	0	2	0	0	0	2	(100)	0	(0)		2
Total	6	2	(25)	0	8	0	0	0	6	(75)	2	(25)		8

[a] Includes permit harvest.

[b] No estimate was made of unreported or illegal kills.

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

Table 6 Unit 26B brown bear harvest data by permit hunt, regulatory years 1987–1988 through 1997–1998

Hunt/Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunt	Percent successful hunters	Males	Females	Unk	Total harvest
Fall hunts									
(288)	1987–1988	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	1988–1989	n/a	n/a	1	3	1	2	0	3
	1989–1990	n/a	n/a	n/a	n/a	n/a	n/a	4	4
	1990–1991	6	33	0	66	1	2	1	4
	1991–1992	6	33	0	66	4	0	0	4
	1992–1993	6	50	0	50	1	3	0	3
(DB987)	1993–1994	6	50	17	33	0	2	0	2
	1994–1995	6	50	0	100	3	0	0	3
	1995–1996	6	0	17	83	4	1	0	5
	1996–1997[a]								
	1997–1998[a]								
Spring hunts									
(297)	1987–1988	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	1988–1989	n/a	n/a	n/a	n/a	3	0	0	3
	1989–1990	n/a	n/a	n/a	n/a	0	0	3	3
	1990–1991	4	0	0	100	4	0	0	4
	1991–1992	4	25	0	75	3	0	0	3
	1992–1993	2	0	50	50	0	0	1	1
(DB997)	1993–1994	0	0	0	0	0	0	0	0
	1994–1995	0	0	0	0	0	0	0	0
	1995–1996	0	0	0	0	0	0	0	0
	1996–1997[a]								
	1997–1998[a]								
Totals for	1987–1988	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
all permit	1988–1989	n/a	n/a	n/a	n/a	4	2	0	6
hunts	1989–1990	n/a	n/a	n/a	n/a	n/a	n/a	7	7

Hunt/Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunt	Percent successful hunters	Males	Females	Unk	Total harvest
	1990–1991	10	20	0	80	5	2	1	8
	1991–1992	10	30	0	70	7	0	0	7
	1992–1993	8	38	12	50	1	3	1	4
	1993–1994	6	50	17	33	0	2	0	2
	1994–1995	6	50	0	100	3	0	0	3
	1995–1996	6	0	17	83	4	1	0	5
	1996–1997[a]								
	1997–1998[a]								

[a] The nonresident drawing hunt in Unit 26B was eliminated in RY 1996–1997 and reinstated in RY 1998–1999.

Table 7 Unit 25A residency of successful brown bear hunters[a], regulatory years 1985–1986 through 1997–1998

Regulatory year	Local[b] resident (%)	Nonlocal resident (%)	Nonresident (%)	Total successful hunters
1985–1986	1 (11)	2 (22)	6 (67)	8
1986–1987	0 (0)	6 (50)	6 (50)	12
1987–1988	0 (0)	3 (23)	10 (77)	13
1988–1989	1 (5)	8 (38)	12 (57)	21
1989–1990	1 (8)	2 (17)	9 (75)	12
1990–1991	2 (14)	6 (43)	6 (43)	14
1991–1992	1 (7)	4 (27)	10 (67)	15
1992–1993	0 (0)	6 (38)	10 (62)	16
1993–1994	0 (0)	4 (50)	4 (50)	8
1994–1995	0 (0)	8 (62)	5 (38)	13
1995–1996	0 (0)	4 (29)	10 (71)	14
1996–1997	0 (0)	2 (10)	18 (80)	20
1997–1998	0 (0)	3 (25)	9 (75)	12

[a] Includes permit harvest.

[b] Includes only residents of the subunit.

Table 8 Unit 25B and 25D residency of successful brown bear hunters[a], regulatory years 1985–1986 through 1997–1998

Regulatory year	Local[b] resident (%)	Nonlocal resident (%)	Nonresident (%)	Total successful hunters
1985–1986	0 (0)	0 (0)	2 (100)	2
1986–1987	0 (0)	1 (25)	3 (75)	4
1987–1988	0 (0)	2 (40)	3 (60)	5
1988–1989	1 (25)	0 (0)	3 (75)	4
1989–1990	1 (20)	1 (20)	3 (60)	5
1990–1991	1 (20)	3 (60)	1 (20)	5
1991–1992	0 (0)	0 (0)	2 (100)	2
1992–1993	1 (25)	0 (0)	3 (75)	4
1993–1994	0 (0)	2 (100)	0 (0)	2
1994–1995	2 (50)	2 (50)	0 (0)	4
1995–1996	0 (0)	1 (50)	1 (50)	2
1996–1997	1 (33)	0 (0)	2 (33)	3
1997–1998	0 (0)	0 (0)	0 (0)	0

[a] Includes permit harvest.

[b] Includes only residents of the subunit.

Table 9 Unit 26B residency of successful brown bear hunters[a], regulatory years 1985–1986 through 1997–1998

Regulatory year	Local[b] resident (%)	Nonlocal resident (%)	Nonresident (%)	Total successful hunters
1985–1986	0 (0)	0 (0)	6 (100)	6
1986–1987	0 (0)	2 (40)	3 (60)	5
1987–1988	0 (0)	6 (46)	7 (54)	13
1988–1989	0 (0)	4 (44)	5 (56)	9
1989–1990	0 (0)	7 (47)	8 (53)	15
1990–1991	0 (0)	4 (33)	8 (66)	12
1991–1992	0 (0)	10 (59)	7 (41)	17
1992–1993	0 (0)	9 (64)	4 (29)	14
1993–1994	0 (0)	10 (83)	2 (17)	12
1994–1995	0 (0)	9 (75)	3 (25)	12
1995–1996	0 (0)	6 (55)	5 (45)	11
1996–1997	1 (4)	11 (44)	13 (57)	25
1997–1998	0 (0)	9 (35)	16 (64)	25

[a] Includes permit harvest.

[b] Includes only residents of the subunit.

Table 10 Unit 26C residency of successful brown bear hunters[a], regulatory years 1985–1986 through 1997–1998

Regulatory year	Local[b] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total successful hunters
1985–1986	0	(0)	4	(66)	2	(33)	6
1986–1987	0	(0)	6	(66)	3	(33)	9
1987–1988	0	(0)	5	(63)	3	(37)	8
1988–1989	0	(0)	3	(50)	3	(50)	6
1989–1990	0	(0)	0	(0)	2	(100)	2
1990–1991	0	(0)	3	(50)	3	(50)	6
1991–1992	0	(0)	4	(50)	4	(50)	8
1992–1993	1	(17)	1	(17)	4	(66)	6
1993–1994	1	(14)	6	(86)	0	(0)	7
1994–1995	0	(0)	2	(50)	2	(50)	4
1995–1996	0	(0)	0	(0)	7	(100)	7
1996–1997	0	(0)	4	(50)	4	(50)	8
1997–1998	2	(25)	0	(0)	6	(75)	8

[a] Includes permit harvest.

[b] Includes only residents of the subunit.

LOCATION

GAME MANAGEMENT UNIT: 26A (56,000 mi^2)

GEOGRAPHIC DESCRIPTION: Western North Slope

BACKGROUND

Densities of brown/grizzly bears vary widely in Unit 26A, with densities highest in the foothills of the Brooks Range and lowest in the northern portion of the unit. Bear populations were reduced during the 1960s by hunting but are currently stable or slowly increasing. Hunters, particularly those from out of state, have continued to show an interest in hunting bears in Unit 26A. Subsistence hunting regulations for the Northwest Alaska Brown Bear Management Area (NWABBMA) allow residents to hunt brown bears primarily for food in Units 21D, 23, 24, and 26A.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

- Maintain a grizzly bear population of approximately 800 bears or greater.
- Maintain a harvest success rate of least 60%.
- Minimize adverse interactions between grizzly bears and the public.

METHODS

There has been a radiotelemetry study in the southern portion of Unit 26A for a number of years, with methods previously reported in research progress reports (Reynolds 1983, 1984, 1989) and management reports (Trent 1985, 1988, 1989; Carroll 1993).

Population densities for broad habitat zones in Unit 26A were estimated using subjective comparisons to areas of the North Slope with known bear densities. The habitat zones include the coastal plain (<800 ft elevation), the foothills (800–2500 ft elevation), and mountains (>2500 ft elevation). Bear densities within these habitat zones are available from studies in the western Brooks Range (1992), the Arctic National Wildlife Refuge (1982–1990), the Canning River and Ivashak River drainages (1973–1975), and the Prudhoe Bay oilfield area (1990–1993).

We used brown bear sealing certificates to determine seasonal harvests. For sealed bears we summarized the date and location of taking, skull sizes, and sex/age composition of harvested animals. Hunting activity was summarized by residency of hunters and their methods of transportation. We used informal information from village residents to assess unreported harvest of bears. For reporting population estimates and harvest summaries, we divided Unit 26A at 159° W longitude into Unit 26A East and Unit 26A West.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The most recent bear density information comes from June 1992 for the Utukok and Kokolik drainages in Unit 26A West. The density was calculated at 29.5 bears/1000 km^2 with a 95% confidence interval of 28.1–31.5 bears/1000 km^2 (Reynolds, personal communication).

The current population estimate for bears in Unit 26A is 900–1120 bears (Reynolds 1989). We estimate there are 400 bears in Unit 26A West and 500–720 bears in Unit 26A East (Table 1). This represents a substantial increase from the pre–1987 population estimate of 645–780 bears.

Bear populations in the Brooks Range apparently declined during the 1960s due to guided hunting (Reynolds, personal communication) and have been recovering since permit hunts were instituted during the 1977–78 regulatory year (Trent 1988). Bear densities appear to be at high levels relative to carrying capacity of the habitat.

Population Composition

The most recent population composition and productivity data are available from Reynolds (1984) for the western portion of the unit in the Utukok and Kokolik drainages. The sex ratio for bears older than 1 year was approximately 40 males/60 females; for cubs and yearlings it was approximately 50:50 but may have slightly favored females.

Age composition was as follows: cubs of the year, 13%; yearlings, 10%; 2-year-olds, 14%; 3 and 4-year-olds, 11%; and bears over 5 years, 52%. Mean age at first reproduction was 8.0 years, mean litter size was 2.0 cubs, mean reproductive interval was 4.0 years, and mean productivity was 0.5 cubs/year.

Distribution and Movements

We estimate densities for habitat zones in Unit 26A at 0.5–2 bears/1000 km^2 on the coastal plain, 10–30 bears/1000 km^2 in the foothills, and 10–20 bears/1000 km^2 in the mountains. These densities yield an estimated total of 1007 bears, with 81 in the coastal plain, 666 in the foothills, and 260 in the mountains.

MORTALITY

Harvest

Season and Bag Limit.

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 26A – General Hunt		
Resident and Nonresident Hunters: 1 bear every 4 regulatory years	20 Aug–31 May	20 Aug–31 May
Unit 26A Resident Hunters: 1 bear per regulatory year by registration permit in the Northwest Alaska Brown Bear Management Area for subsistence purposes.	20 Aug–31 May (Subsistence hunt only)	
Nonresident Hunters		No open season

Board of Game Actions and Emergency Orders. During their spring 1996 meeting, the board eliminated the drawing permit requirements for nonresident brown bear hunters in Unit 26A and lengthened the season to 20 August–31 May. The change was made to simplify the complex permit system. The harvest in Unit 26A had been well below the maximum sustained yield and the permit hunt was undersubscribed. Our goal will be to keep the harvest at or below an average of 5% of the bear population during any 2-year period. Therefore, the maximum allowable harvest will be 31 bears per year in Unit 26A East and 20 bears in Unit 26A West. If this quota is exceeded during one year then the quota for the next year will be reduced by as much as it was exceeded during the first year. If the average is exceeded, more restrictive regulatory action, including emergency orders, will be considered. The system will depend upon open lines of communication among the Department, guides, and hunters.

Hunter Harvest. Twenty bears were sealed during 1996–1997. One bear was killed in defense of life and property (DLP). Eight bears were killed in Unit 26A West and 12 in Unit 26A East (Table 1). Fourteen bears were males and 6 were females (Table 2).

Twenty bears were also sealed during 1997–1998. Six bears were killed in Unit 26A West and 14 in Unit 26A East (Table 1). Thirteen bears were males and 7 were females (Table 2).

The reported harvest in 1996–1997 and 1997–1998 was less than the average number harvested in past years. The high harvests reported in 1990–1991 and 1991–1992, 32 and 34 bears, respectively, remain the highest reported harvests for Unit 26A (Table 2).

For bears harvested during 1996–1997, the mean skull size for males was 20.9 inches and 19.5 inches for females; the mean age was 7.8 years for males and 6.0 years for females.

During 1997–1998 the mean skull size for males was 21.4 inches and 19.3 inches for females; the mean age was 8.5 years for males and 7.6 years for females (Table 3).

Hunter Residency and Success. Of the 20 bears sealed in Unit 26A during 1996–1997, 18 were harvested by nonresidents, 0 by nonlocal Alaska residents, and 2 by North Slope residents. During 1997–1998, 18 of 20 bears were harvested by nonresidents, 1 by a nonlocal Alaska resident, and 1 by a North Slope resident (Table 4).

Harvest Chronology. During 1996–1997 5 bears were harvested during August, 11 in September, 1 in October, 1 in April, and 2 in May. In 1997–1998 11 bears were harvested in August, 5 in September, 1 in April, and 3 in May (Table 5).

Transport Methods. Most bear hunters continued to use aircraft as transportation in Unit 26A. During 1996–1997 15 hunters used aircraft for transportation, 1 used a snowmachine, 1 used an ORV, and 2 walked. Seventeen hunters used aircraft during 1997–1998, 2 used snowmachines, and 1 used a boat (Table 6).

Other Mortality

No recent estimate of natural mortality for grizzly bears in Unit 26A is available. However, Reynolds and Hechtel (1983) reported mortality rates among offspring accompanied by marked adult females in the western Brooks Range to be 44% for cubs, 9% for yearlings, and 14 % for 2-year-olds from 1977–81.

HABITAT

Assessment

Most of the brown bear habitat in Unit 26A remains undisturbed and supports a fairly large and growing population of bears. It would be difficult to evaluate many of the food sources for brown bears in Unit 26A, such as herbivorous forage and ground squirrels. Caribou represent a large food resource available to bears for at least part of the year. The recent major decline in the Colville River moose population may affect bear numbers.

Potential hazards to brown bear habitat include oil and mineral exploration and development. Exploration is currently underway in Unit 26A, including areas within the foothills on the north side of the Brooks Range.

Some areas in Unit 26A, particularly some east/west-oriented ridges, are used much more heavily than the surrounding area by brown bears for at least part of the year (Reynolds, personal communication). An attempt should be made to catalogue as many of these areas as possible. These areas should be considered critical habitat for brown bears and given special protection in the future.

Enhancement

There were no habitat enhancement activities in Unit 26A during the reporting period.

CONCLUSIONS AND RECOMMENDATIONS

Hunters reported 20 bears harvested during both the 1996–1997 and 1997–1998 seasons. This was lower than the average number of bears harvested since 1990 (27.3) and well below the allowable sustained yield of approximately 51 bears. The reported harvests in Unit 26A East, of 12 bears in 1996–1997 and 14 bears in 1997–1998, and Unit 26A West, of 8 bears in 1996–1997 and 6 in 1997–1998, were well below the allowable limits of 31 and 20, respectively. Even if unreported harvest is as high as 50% of the reported harvest, the total estimated harvest of 30 bears would still be within safe harvest limits.

Oil and mineral exploration and development are potential hazards to brown bear habitat. Reynolds has stated that some areas, particularly some east/west-oriented ridges, have very high brown bear densities. We should identify these critical habitat areas and catalogue them so they can be given special protection during upcoming mineral exploration and development projects.

A significant management problem in Unit 26A continues to be unreported harvest and non-compliance with bear hunting regulations. To accommodate rural hunting practices, the Board of Game established the Northwest Alaska Brown Bear Management Area (NWABBMA) with alternate hunting regulations for subsistence users in 1992. The regulations are designed for people who hunt bears for food. The regulations eliminate tags and sealing procedures and allow harvest reports by mail. Hopefully, these regulations will improve harvest reporting and compliance.

One problem not addressed by the current regulatory system or the special management area regulations is that accurate harvest information still depends upon hunters buying licenses and reporting their harvest. Many local hunters do not buy hunting licenses or report their harvest. To help alleviate this problem, Alaska Department of Fish and Game personnel worked with the North Slope Borough to develop a harvest documentation system that is more acceptable to local residents. Harvest monitors have been hired in some villages and are collecting harvest information for several species.

In 1996 the Board of Game discontinued the brown bear drawing permit system and lengthened the season in Unit 26A. It was surprising that in 1996–1997 and in 1997–1998 bear harvest was less than average even though the regulations were liberalized. This might be explained by a lack of a concurrent moose season and hunters that would have secondarily harvested bear while hunting moose. Eliminating the drawing permit system has reduced paper work and time spent administering the hunt and has not led to overharvest. We will continue communicating with the guides and urging them to limit their harvests and to be selective toward males. We do not recommend any changes in seasons or bag limits at this time.

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PREPARED BY:

Geoff Carroll
Wildlife Biologist III

SUBMITTED BY:

Peter Bente
Survey-Inventory Coordinator

Table 1 Reported harvest of brown/grizzly bears in Unit 26A, 1988–1998

Unit	Estimated population Size	Harvest of 5%	Reported harvest									
			88–89	89–90	90–91	91–92	92–93	93–94	94–95	95–96	96–97	97–98
26A West	400	20	25	12[a]	16	13[A]	16	9[a]	7	6	8	6
26A East	500–720	25–36	6	14	16[a]	21	13	17	13	17	12	14
Total	900–1200	45–56	31	26[a]	32[a]	34[a]	29	26[a]	20	23	20	20

[a] Includes DLP-killed bears

Table 2 Unit 26A brown bear harvest[a], 1985–1998

Regulatory Year	Hunter harvest M	(%)	F	(%)	Unk.	Total	Non-hunting kill	Total	Unreported est. kill	Total est. kill
1985–1986										
Fall 1985	3	(43)	4	(57)		7				
Spring 1986	2	(40)	3	(60)		5				
Total	5	(42)	7	(58)		12	2	14	5–7	19–21
1986–1987										
Fall 1986	10	(77)	3	(23)		13				
Spring 1987	6	(86)	1	(14)		7				
Total	16	(80)	4	(20)		20		20	8–11	28–31
1987–1988										
Fall 1987	11	(58)	8	(42)		19				
Spring 1988	2	(67)	1	(33)		3				
Total	13	(59)	9	(41)		22		22	8–12	30–34
1988–1989										
Fall 1988	12	(71)	5	(29)		17				
Spring 1989	11	(79)	3	(21)		14				
Total	23	(74)	8	(26)		31		31	12–17	43–48
1989–1990										
Fall 1989	10	(53)	9	(47)		19				
Spring 1990	7	(100)	0			7				
Total	17	(63)	9	(33)	1	27		27	8–13	34–39
1990–1991										
Fall 1990	15	(75)	5	(25)		20				
Spring 1991	8	(73)	3	(27)		11				
Total	23	(74)	8	(26)		31	1	32	5–8	37–40
1991–1992										
Fall 1991	22	(81)	5	(19)		27				
Spring 1992	6	(100)	0			6				
Total	28	(82)	5	(15)	1	34	0	34	5–8	39–42

Table 2 Continued

Regulatory Year	Hunter harvest M	(%)	F	(%)	Unk.	Total	Non-hunting kill	Total	Unreported est. kill	Total est. kill
1992–1993										
Fall 1992	18	(95)	1	(5)		19				
Spring 1993	8	(80)	2	(20)		10				
Total	26	(90)	3	(10)		29	0	29	4–9	33–38
1993–1994										
Fall 1993	11	(79)	3	(21)		14				
Spring 1994	8	(89)	1	(11)		9				
Total	19	(83)	4	(17)		23	3	26	3–6	29–34
1994–1995										
Fall 1994	9	(75)	3	(25)		12				
Spring 1995	7	(88)	1	(12)		8				
Total	16	(80)	4	(20)		20	0	20	3–4	23–24
1995–1996										
Fall 1995	7	(53)	6	(47)		13				
Spring 1996	6	(60)	3	(30)	1(10)	10				
Total	13	(57)	9	(39)	1(10)	23	2	23	3–6	28–31
1996–1997										
Fall 1996	11	(69)	5	(31)		16	0			
Spring 1997	2	(67)	1	(34)		3	0	3	1	
Total	13	(68)	6	(32)		19	1	20	2–4	22–24
1997–1998										
Fall 1997	11	(69)	5	(31)		16	0			
Spring 1998	2	(50)	2	(50)		4				
Total	13	(65)	7	(35)		20	0	20	2–4	22–24

[a] Permit hunt harvest included.

[b] Includes DLP kills, research mortalities, and other known human caused accidental mortality.

Table 3 Unit 26A brown bear skull size and age, 1985–1998

	Mean skull size, inches				Mean age, years			
Regulatory year	Male	*n*	Female	*n*	Male	*n*	Female	*n*
1985–1986	20.6	5	20.2	5	8.8	5	10.3	5
1986–1987	20.9	10	19.2	5	8.2	12	4.6	5
1987–1988	22.5	16	20.0	9	11.1	16	11.9	9
1988–1989	22.0	14	19.9	6	11.2	13	9.2	6
1989–1990	21.5	17	19.7	8	9.8	16	11.7	9
1990–1991	21.1	22	19.5	8	10.1	22	7.8	8
1991–1992	20.0	28	19.9	5	7.9	25	16.6	4
1992–1993	21.2	17	19.0	1	8.3	17	3.0	1
1993–1994	20.9	11	19.0	3	8.0	10	4.3	3
1994–1995	21.4	16	18.8	4	7.7	14	3.5	4
1995–1996	21.2	13	19.1	7	8.1	12	6.1	4
1996–1997	20.9	12	19.5	6	7.8	12	6.0	6
1997–1998	21.4	10	19.3	6	8.5	11	7.6	5

Table 4 Unit 26A brown bear successful hunter[a] residency, 1985–1998

Regulatory year	Local resident	Nonlocal resident	Nonresident	Unknown	Total hunters
1985–1986	2	7	2	1	12
1986–1987	0	8	12		20
1987–1988	1	8	13		22
1988–1989	1	10	20		31
1989–1990	2	12	13		27
1990–1991	1	9	21		31
1991–1992	2	15	16		33
1992–1993	1	8	20		29
1993–1994	1	10	12		23
1994–1995	0	5	15		20
1995–1996	6	4	13		23
1996–1997	2	0	18	0	20
1997–1998	1	1	18	0	20

[a]Hunters in permit hunts are included.
[b]Local means North Slope residents.

Table 5 Unit 26A brown bear harvest chronology by time period, 1985–1998

Regulatory Year	Aug	Sep	Oct	Nov	Apr	May	June	*n*
1985–1986		6	1	0	0	5	0	12
1986–1987		13	0	0	0	7	0	20
1987–1988		19	0	0	0	3	0	22
1988–1989		17	0	0	0	14	0	31
1989–1990	1[a]	18	1	0	0	7	0	27
1990–1991	1	18	1	0	1	10	0	31
1991–1992	0	25	2	0	3	3	0	33
1992–1993	0	18	1	0	6	4	0	29
1993–1994	0	13	1	0	4	5	0	23
1994–1995	0	12	0	0	0	8	0	20
1995–1996	0	11	2	0	2	8	0	23
1996–1997	5	11	1	0	1	2	0	20
1997–1998	11	5	0	0	1	3	0	20

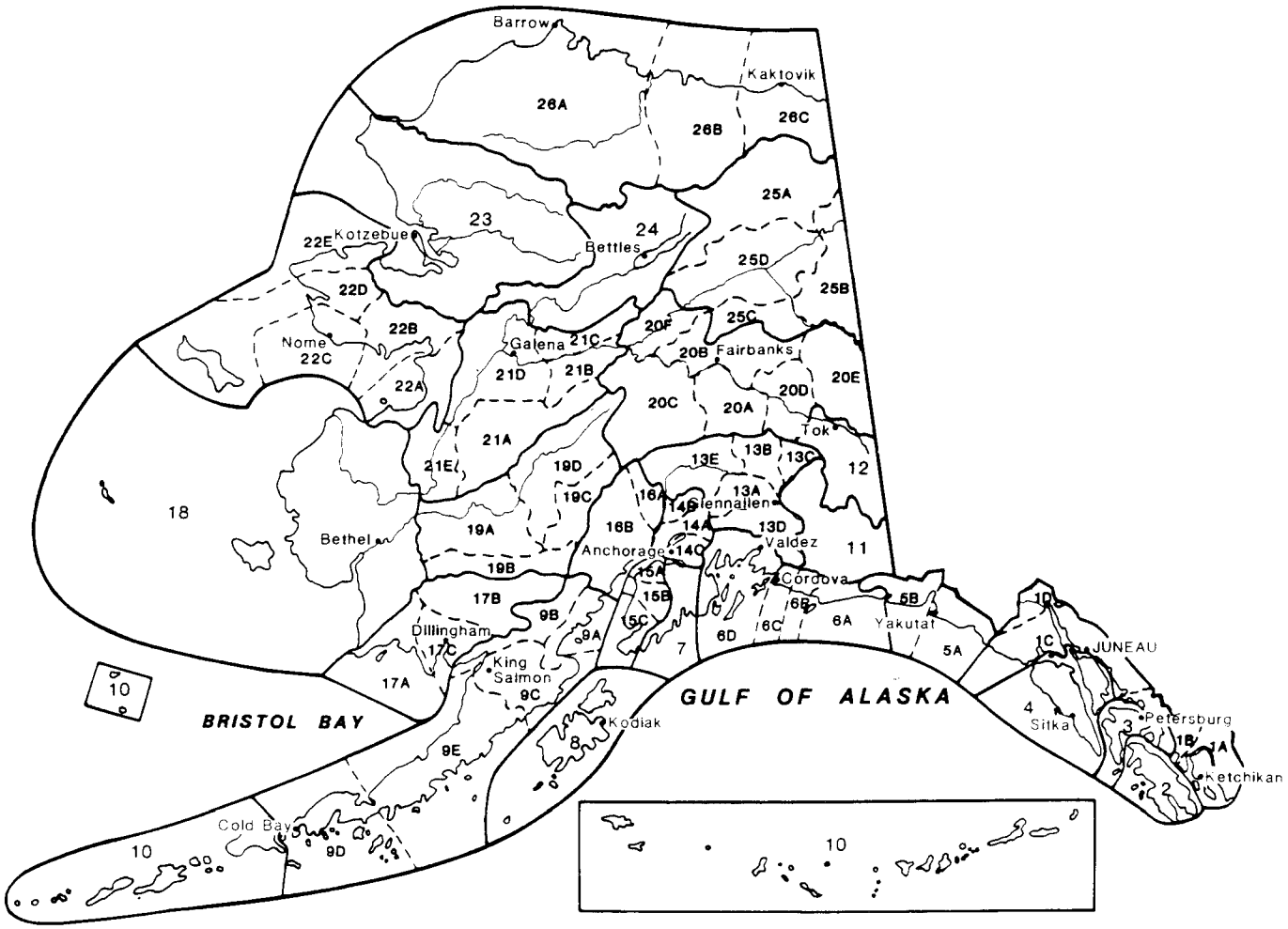
[a]DLP kill.

Table 6 Unit 26A brown bear harvest[a] percent by transport method, 1985–1998.

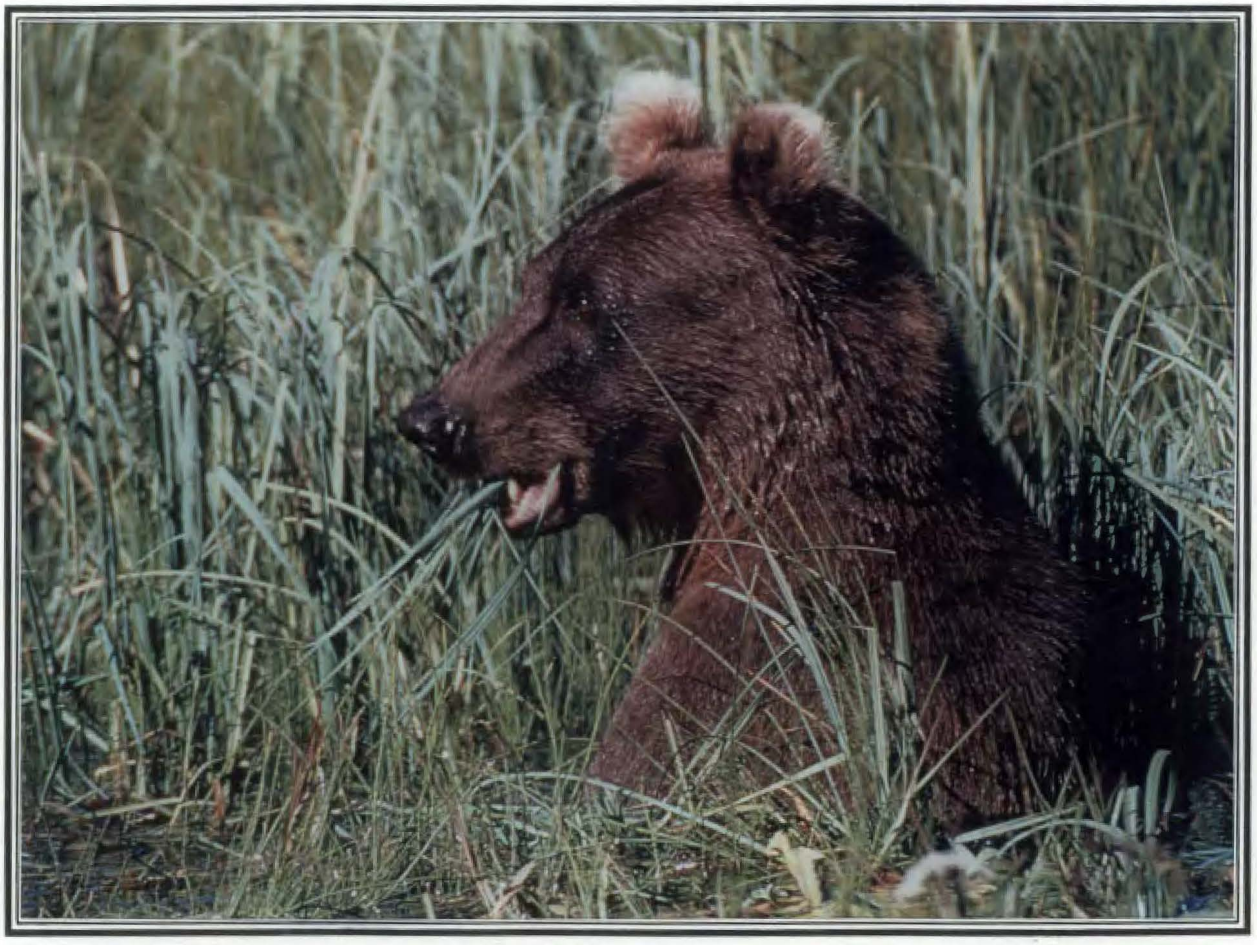
Regulatory Year	Transport method for brown bear harvest: Airplane		Horse		Boat		Snowmachine		ORV		Walk		Unknown		Total
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*
1985–1986	7	(50)	2	(14)			3	(22)			1	(7)	1	(7)	14
1986–1987	19	(95)							1	(5)					20
1987–1988	20	(92)					1	(4)	1	(4)					22
1988–1989	27	(87)			3	(10)			1	(3)					31
1989–1990	21	(78)			3	(11)	1	(4)	1	(4)					27
1990–1991	26	(84)							3	(10)			2	(6)	31
1991–1992	30	(91)					2	(6)					1	(3)	33
1992–1993	24	(83)					5	(17)							29
1993–1994	15	(65)			3	(13)	4	(18)			1	(4)			23
1994–1995	15	(75)			1	(5)	3	(15)			1	(5)			20
1995–1996	12	(52)			2	(9)	7	(30)			2	(9)			23
1996–1997	15	(75)					1	(5)	1	(5)	2	(10)	1	(5)	20
1997–1998	17	(85)			1	(5)	2	(10)							20

[a] Permit hunt harvest is included.

Alaska's Game Management Units



The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program allots funds back to states through a formula based on each state's geographic area and number of paid hunting license holders. Alaska receives a maximum 5% of revenues collected each year. The Alaska Department of Fish and Game uses federal aid funds to help restore, conserve, and manage wild birds and mammals to benefit the public. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes for responsible hunting. Seventy-five percent of the funds for this report are from Federal Aid.



Gerhard Kraus