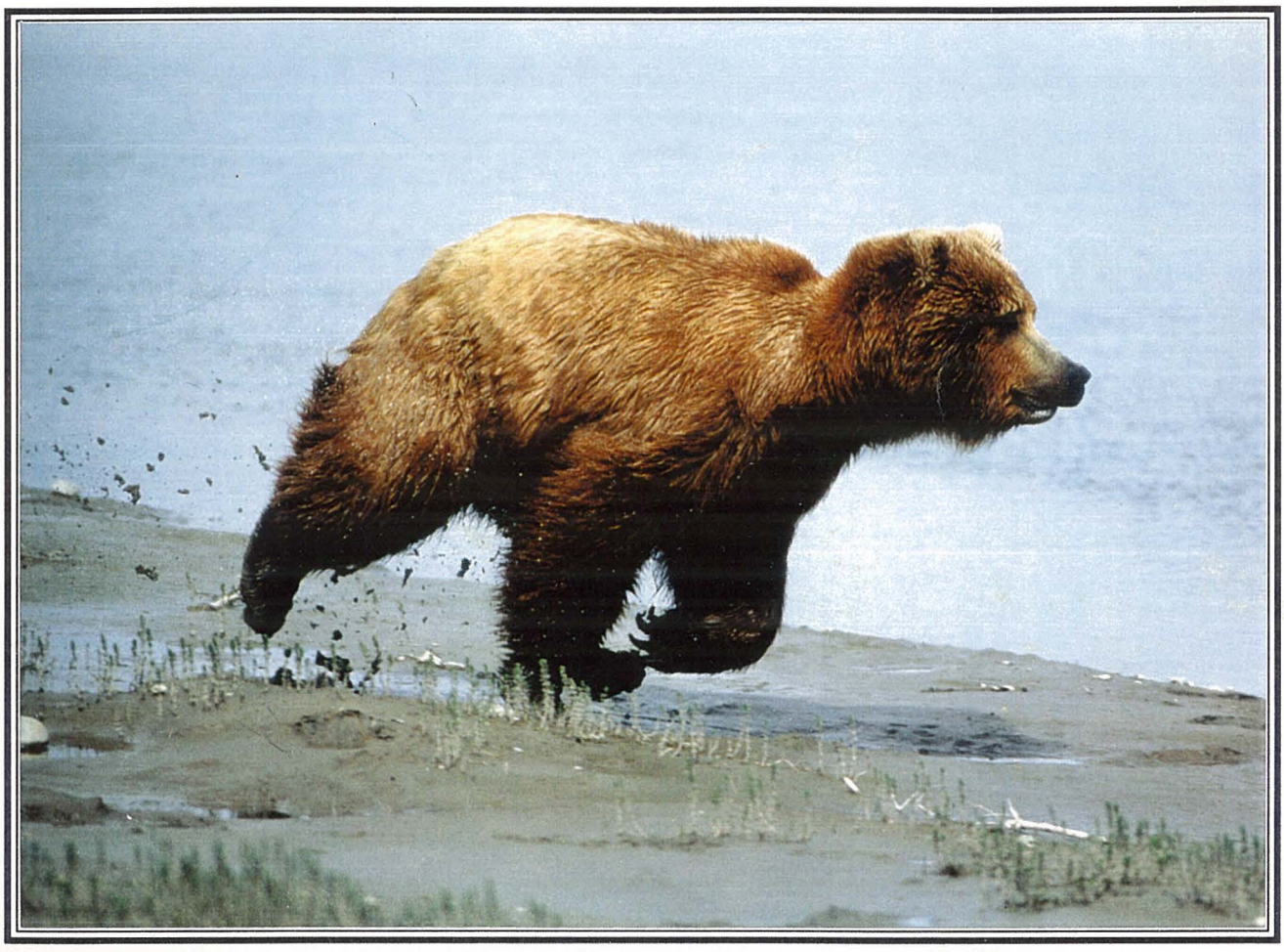
Alaska Department of Fish and Game
Division of Wildlife Conservation

Federal Aid in Wildlife Restoration
Management Report
Survey-Inventory Activities
1 July 1994 - 30 June 1996

BROWN BEAR

Mary V. Hicks, Editor



Ken Whitten

Grants W-24-3 & W-24-4
Study 4.0
September 1998

STATE OF ALASKA
Tony Knowles, Governor

DEPARTMENT OF FISH AND GAME
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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 Camano 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 along with the coastal mainland; however, they are only known to coexist with black bears on mainland portions of the panhandle. Although extensive research of brown bears 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, and mandatory sealing data.

Prior to 1968, hunters were allowed to harvest 1 brown bear annually from any part of Alaska during 1 September–10 June. Subsequently, the regulation changed so that hunters are now restricted to 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 Southeast Alaska since 1989 (McCarthy 1991, Larsen 1993). Previously, hunters were only required to obtain a license and metal-locking tag prior to hunting. Brown bear sealing requirements have been in effect in Alaska since 1961.

Historically, nearly half of the unit's annual brown bear harvest has come from Subunit 1D, located in the northern part of the region (Haines area). Subunits 1A (Ketchikan area), 1B (Wrangell/Petersburg area), and 1C (Juneau area) each account for 5–40% of the annual harvests. 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 kills, small bears are often passed up by hunters who hope to ultimately encounter and harvest a large bear during their hunt. This partially accounts for the relatively low success rates noted for brown bear hunters in Southeast Alaska.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Our management objectives for Unit 1 brown bears are to: 1) maintain an average age of annually harvested males no less than 6.5 years, with a male:female harvest ratio of at least 3:2, and 2) reduce the numbers 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 location of kill. 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 our office in Anchorage where lab staff determine ages after sectioning and staining the teeth.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Quantitative population data are not available for brown bears in Unit 1. However, 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. Harvests from each of the unit's subunits during 1994–96 were similar to those reported during past seasons (Table 1). Subunit 1D continued to account for nearly half of the bears harvested from the unit.

One female brown bear was killed in defense of life and property (DLP) in Subunit 1D during fall 1994, and two additional females were killed DLP in Subunit 1C during fall 1995 (Table 2). This was down from the five DLPs reported during 1992–94. A sow and a boar were killed illegally in Subunit 1D during fall 1994, and another sow was illegally killed in Subunit 1D during fall 1995 along with a boar in Subunit 1C. Hunters who failed to obtain registration permits before hunting (Table 2) shot 2 boars in 1C during spring 1996.

Unreported kills are estimated at 10% of the reported harvest, although this is considered conservative (McCarthy 1991) (Table 2). Total estimated human-caused mortality for Unit 1 is derived by adding the reported harvest, DLP kills, and known and estimated unreported/illegal harvests. The estimates for 1994-96 are similar to those derived in past years (Table 2).

Harvests of males have consistently surpassed our management objective of 60% (Table 2). During the past 2 seasons males constituted 62% and 80% of the annual harvests. Harvests are most noticeably skewed toward males during spring seasons (Table 2). We suspect this is at least partly due to the fact that it is illegal to harvest females accompanied by cubs. As sows and

second-year cubs separate at the end of spring seasons, they become legal to hunters and the proportion of females in the harvest increases during fall.

Mean skull sizes of male and female brown bears harvested during the past 2 seasons remained relatively unchanged from previous season averages, although the female average of 21.4 inches observed during 1995–96 marked a new season high (Table 3). Average ages of harvested male bears remained consistent with past averages; however, coincident with the high average size of female skulls, the average female age increased to a record high of 16 years during 1995–96 (Table 3).

Permit Hunts. Registration permits have been used by Unit 1 brown bear hunters since fall 1989 (Table 4). Compliance with the permits has been excellent during the past several seasons, although it has required that we put a good deal of postseason effort into contacting non-reporting hunters and reminding them to provide us with required hunt information.

Hunter Success and Residency. Similar to past seasons, about half of the hunters with permits during 1994–96 did not hunt (Table 4). Of the 296 people who hunted, 20% were successful.

For the first time on record, nonresident hunters accounted for more bear harvests than local and nonlocal residents during 1994–95 and 1995–96 (Table 5). We attribute this to the marked increase in registered guide activity in the unit during the past 2 seasons.

Harvest Chronology. Collectively for the past 11 seasons, the annual Unit 1 brown bear harvest has been fairly evenly split between fall and spring seasons; however, nearly 60% of the past 2 seasons' harvests have been taken during spring (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. Although to date this has been especially true in Subunits 1B and 1C, future timber harvest scheduled to occur on the Cleveland Peninsula in Subunit 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 at new logging and mining camps, where bears become attracted and accustomed to garbage dumps.

CONCLUSIONS AND RECOMMENDATIONS

The registration permit first implemented in 1989 continues to provide us with complete and useful information about brown bear hunting effort and success in Unit 1. Our objective of having a 3:2 harvest ratio of males to females has been achieved during each of the past 2

seasons and 9 of the past 11 seasons. Similarly, ages of harvested males have averaged above our objective of 6.5 years during the past 2 seasons and 9 of the past 11 seasons.

Our objective of reducing DLP kills was met during this reporting period. The 3 DLP kills reported during 1994–96 were down 2 from the previous report period, reducing numbers of bears killed because of garbage habituation in the unit. However, despite this 2-year decrease, we recognize long-term success in reducing bear/human conflicts lies directly with the public's willingness to adopt and adhere to responsible garbage storage policies.

Based on our harvest data and observations and reports by the public and our staff, we believe the Unit 1 brown bear population remained stable 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 region.

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Table 1 Unit 1 brown bear harvests by subunit[a], 1985–1996

	Subunit									
	1A		1B		1C		1D			
Year	Harvest	% of Total	Harvest	% of Total	Harvest	% of Total	Harvest	% of Total	Total	Harvest
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
Totals	50	(18)	54	(20)	40	(15)	126	(47)		270

[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, 1985–1996

Regulatory Year	Reported: Hunter kill M (%)	F (%)	Unk.	Total	Reported: Nonhunting kill[a] M	F	Unk.	Estimated kill: Unreported Illegal[b]	Total estimated kill 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	0	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
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

Table 2 Continued

[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 a male illegally killed at a black bear bait station in Subunit 1D, and a female killed in Subunit 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, one female taken illegally.
[h] Two males taken by hunters who failed to obtain registration permits.

Table 3 Ages and skull sizes of brown bears harvested in Unit 1, 1985–1996

	Mean Skull Size[a]				Mean Age[b]			
Season	Male	n	Female	n	Male	n	Female	*n*
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

[a] Skull sizes equal length plus zygomatic width.
[b] Determined through analyses of extracted premolar teeth.
[c] Includes a female taken illegally by a hunter who failed to obtain a registration permit.
[d] Includes 2 males taken illegally in Subunit 1C by hunters who failed to obtain registration permits.

Table 4 Unit 1 brown bear registration permit data, 1989–1996

Season/ Hunt No.	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
(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
Totals	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

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

Table 5 Residency of successful brown bear hunters[a], Unit 1, 1985–1996

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

[a] Does not include illegal harvests.
[b] Local residents are those hunters who reside in Unit 1.
[c] Prior to 1989-90, all harvest data was obtained solely from sealing records.

Table 6 Seasonal chronology of brown bear harvest[a], Unit 1, 1985–1996

	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)
Totals	141	(52)	129	(48)

[a] Does not include illegal harvests

Table 7 Monthly Unit 1 brown bear harvest chronology[a], 1985–1996

Regulatory year	Harvest Periods							
	September	October	November	March	April	May	June	*n*
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
Totals	73	51	16	1	7	120	2	270

[a] Does not include illegal harvests.

Table 8 Successful brown bear hunter transport methods[a], Unit 1, 1985–1996

Regulatory Year	Percent of Harvest						
	Airplane	Boat	Walk	ORV	Highway Vehicle	Other/ unknown	*n*
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

[a] Does not include illegal harvests.

LOCATION

GAME MANAGEMENT UNIT: 4 (5,800 mi^2)

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

BACKGROUND

Brown bears inhabit all the major islands in the 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). The Tongass National Forest contains most of the bear's habitat and is managed under a multiple-use concept by the U.S. Forest Service (USFS). On both federal and private lands, extensive long-term commercial logging has altered habitat. Wilderness designations on Admiralty, south Baranof, and west Chichagof islands, however, contain large areas that should continue to provide bears a pristine environment. Elsewhere in the unit habitat alteration by logging will impact brown bear density and distribution.

Unit 4 is the most important brown bear hunting area in Southeast Alaska. It has nearly 70% of the estimated brown bears (Miller 1993*a*) and produced 67% of the harvest in recent years (Miller 1993*b*). Federal assumption of subsistence management under the terms of ANILCA included authority for brown bears on federal lands. This dual authority with the State of Alaska has confused the public and may preclude 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

1. Maintain an average age of harvested males of at least 6.5 years.
2. Maintain a male/female harvest ratio of at least 3:2.
3. 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 the skull, extracted a premolar, determined sex, and recorded data on the date and location of the kill, hunter residency, hunt length, guide services used (if any), and primary transportation. A commercial laboratory determined the age by counting cementum annuli in the 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.

We entered data recorded on sealing forms and registration permit reports into a computer data storage and retrieval program. Delinquent permittees were sent reminder letters and certified letters to improve reporting compliance. The Alaska Department of Public Safety cited permittees who failed to respond.

Questionnaires were sent to 623 U.S. citizens who had obtained registration permits and hunted bear in the unit. The questionnaire sampled individual opinions concerning hunting experience. The data from the responses were pooled into groupings of hunters with common attributes and analyzed for patterns of hunt satisfaction based on the class of hunter and/or the unit area hunted.

Project personnel attempted to reduce DLP incidents through education and cooperation with community authorities and other agencies.

Both the DWC staff and USFS personnel contacted visitors at Pack Creek in the Stan Price State Wildlife Sanctuary. The program was staffed from late June through August to discuss 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*). My analysis of historical harvest data indicates bear numbers probably declined during the mid-1970s but have since recovered. Harvest levels from some areas of the unit continue to warrant close scrutiny. Extension of logging roads, particularly on northeast Chichagof Island, has increased the vulnerability of bears to hunters. High harvest occurs because these 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 in study areas on Admiralty and Northeast Chichagof islands. These studies provide the basis for population estimates for major areas of the unit. Current population estimates for the entire unit is 4500 bears; Northeast Chichagof Controlled Use Area, 600 bears; remainder of Chichagof Island and Yakobi Island, 1100; Baranof and Kruzof islands, 1000; and Admiralty Island, 1800.

Population Composition

Data are lacking on the population composition of free-ranging bears. The number of bears captured by the research programs has been small, and capture bias 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 sealers' misidentification of harvested bears.

In Unit 4 the 1994–95 harvest by hunter was 75% males (n = 83) and 25% females (n = 28). The 1995–96 harvest was 72% males (n = 89) and 28% females (n = 35). Table 1 displays sex information for the last 5 regulatory years.

Distribution and Movements

Researchers continued to monitor radiocollared bears on 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 range. 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 Mar15–May 31
1 bear every 4 regulatory years by registration permit only	
Unit 4: the Northeast Chichagof Controlled Use Area	Mar 15–May 20
1 bear every 4 regulatory years by registration permit only	

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

1 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 1994–95: Hunters took 19 brown bears in fall 1994 and 92 in spring 1995. The total for the year was 111 bears. Additionally, 7 bears died, bringing the yearly total to 118 bears.

Regulatory Year 1995–96: Hunters took 34 bears in fall 1995 and 92 in spring 1996. Hunting accounted for 124 bears and 15 other bears were reported killed; the combined mortality for the year was 139 bears. Distribution of brown bear harvests for the past 5 years are presented in Tables 1 and 2.

The hunter harvest, DLP, and nonlegal mortality by geographic area in 1994–95 was Baranof–Kruzof, 21 (18%); Admiralty, 43 (36%); and Chichagof 54 (46%). In regulatory year 1995–96 the distribution was 51 bears (39%) from Admiralty, 32 (23%) from Baranof-Kruzof, and 54 (39%) from Chichagof.

The mean age of hunter-killed females was 6.9 years (n = 28) in 1994–95, while males averaged 8.2 years (n = 82). In 1995–96 the mean age of females was again 6.9 years (n = 34), and males averaged 9.0 years (n = 87). The average male skull measurement was 22.2 inches (n = 82) in 1994–95 and 22.6 inches (n = 85) in 1995–96. The long-term trends in skull measurements closely match those found in the age data.

Normal harvest data variation can create problems when making short-term management decisions. Miller and Miller (1990) caution managers about difficulties interpreting harvest data but felt that it is useful as an 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 unified registration permit that covers more than 1 hunt area each season. Hunting pressure in each area is extrapolated 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 took the smallest percentage of bears (Table 3). Most bears were taken by nonresidents or Alaskan hunters from other areas of the state. In 1994–95 nonlocal Alaska hunters and nonresidents composed 71% of hunters, taking 90% of the bears. In 1995–96, 69% of the hunters were nonresidents and nonlocal Alaskans, and they took 86% of the bears. Although 20% of the hunters during the past 2 years lived in Unit 4, they killed only 12% of the bears (1 bear/4.4 hunters). Nonlocal Alaskans composed 42% of hunters and took 23% of the harvest (1 bear/5.1 hunters). Nonresidents composed 38% of the hunters and took 66% of the bears (1 bear/1.5 hunters).

Spring and fall hunting effort is presented in Table 4. In fall 1994 73 Alaska residents hunted 349 days, while 24 nonresidents spent 157 days afield. In fall 1995 69 residents hunted 228 days and 27 nonresidents hunted 131 days. Spring seasons produce a larger harvest (Table 1) and the greater hunting pressure (Table 4). In spring 1995 172 residents hunted 825 days, and 111 nonresidents hunted 752 days. In spring 1996 118 residents hunted 461 days, and 102 nonresidents hunted 586 days. Fall seasons produced 1 bear for every 16 hunt days; spring seasons produced 1 bear for every 13 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 occurs in the fall harvest (Table 1).

The percentage of male bears killed in spring seasons is higher than in the fall, and the actual number of females killed is frequently greater in spring (Table 1). The greatest numbers of bears are available to hunters late in the 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 in grass flats near salt water. In such years harvests are higher than in years with early "green-up" that provides bears with more dispersed feeding opportunities.

Transport Methods. Boats are the most common form of transportation used by bear hunters in Unit 4 (Table 6). In 1994–95, 87% of the successful hunters used boats. In 1995–96 successful hunters used boats 90% of the time. Aircraft are the second most important means of hunter transport but were used by only 9% and 6% of the hunters in 1994–95 and 1995–96 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 DLPs occur that do not involve bears previously habituated to humans.

In 1994–95, 7 nonhunting mortalities were reported (Table 1); 15 occurred in 1995–96. Of these 22 bears, 5 were illegal kills and 17 were taken under the DLP regulations. The distribution of this mortality was Admiralty Island–6 bears, with 4 killed near the community of Angoon; Baranof–Kruzof islands–5 bears, with 2 killed near remote communities; NECCUA–6 bears, with 5 killed near Hoonah; and the remainder of Chichagof Island–5 bears, with 1 killed at a logging camp.

Hunter Questionnaire

The response to the hunter questionnaire indicated that most Unit 4 bear hunters were satisfied with their experience. Successful hunters tended to rate their experience higher (average score of 8.7 on a scale of 1–10) than unsuccessful hunters (average score of 6.8). In no portion of the unit did the analysis identify significant hunter dissatisfaction. Hunters of Admiralty Island, which

has been the focus of claims of unacceptable hunt conditions, scored their experience 7.7 with only 17 % giving a score of 5 or lower. For the Baranof–Kruzof islands, the area that includes the community of Sitka, the average score was 7.6 with 23% rating it at 5 or less. Even with the extensive logging road system and acreage in clear cuts, the average score of NECCUA hunters was 7.5, with 25% rating the hunt 5 or lower. For the remainder of Chichagof Island, the score was 7.6, with 19% rating the hunt 5 or less. However, developments probably had a minimal effect on individual scores because most bear hunting occurs in areas where logging, road, or human habitation are not factors. The questionnaire analysis also documented little support among hunters to change the current brown bear hunting regulations.

Bear Viewing

Public interest in viewing bears has steadily increased at the Stan Price State Wildlife Sanctuary. During summer 1994 1258 people visited the sanctuary, and in 1995 the number of visitors was 1403.

CONCLUSIONS AND RECOMMENDATIONS

Management objectives for harvested male brown bear ages were met in both years. The average age for the 1994–95 regulatory year was 7.9 years and 8.8 in 1995–96; both exceed the 6.5 year minimum objective. The male/female harvest ratio was 3:1.2 in 1994–95 and 3:1.3 in 1995–96, exceeding the management objective of 3:2.

The third objective (reducing the loss of bears due to DLP mortality) is difficult to measure. The Division of Wildlife Conservation continued to work with USFS 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 the water barriers probably restrict dispersal of subadults between areas. Human pressures on brown bears in the unit require the use of all available information concerning the population status for management actions. Currently none of these subpopulations is experiencing excessive human-induced mortality; mortality levels (Table 2) are below the conservative guideline (4% of the population), recommended by Titus (pers. commun.). Attempts to "micro-manage" by smaller areas could redirect hunting pressure and create a "domino effect" of management problems. Future harvest from smaller areas may, however, require regulation change over the larger area to maintain biological or aesthetic standards for hunting. More information on the unit's bear movements is necessary before we manage smaller subpopulations.

The level of bear mortality on Chichagof Island including NECCUA remains a concern. Extension of the controlled use area in 1994 into the area north of Port Frederick in response to extensive logging road construction has prevented excessive harvest. Nonetheless, the rate of human-induced mortality is high (Table 2). Bear habitat on Chichagof Island is less secure; it has experienced the greatest long-term habitat alteration from logging of the larger islands. Retaining

current research on the island's bear population is necessary to provide managers with information on the density of bears in the area.

Overall, the combined mortality from harvest and DLPs in the unit is close to the biological guideline of 4% of the estimated populations (Table 2). Increases in harvest may make it necessary to recommend regulation changes to reduce the trend of increasing bear kills. The removal of the USFS moratorium on the number of guides in December 1995 is allowing new guides to conduct hunts on federal lands. Increased harvests by nonresidents are expected, and the harvest guideline for some areas soon may be exceeded. The USFS is exploring a system of limiting commercial services that could again restrict guide services. The department should cooperate with this program by providing the USFS 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. A secure source of funding needs to be found to maintain this popular "nonhunting" activity.

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Table 1 Unit 4 brown bear harvest, 1991–95

Regulatory Year	Hunter kill					Nonhunting kill[a]				Total Reported
	M	F	(%F)	Unk.	Total	M	F	Unk	Total	
1991										
Fall 91	15	25	(63)	1						
Spring 92	67	16	(19)	0						
Total	82	41	(33)	1	124	6	5		11	135
1992										
Fall 92	17	14	(45)	0						
Spring 93	68	24	(26)	0						
Total	85	38	(31)	0	123	6	1	1	8	131
1993										
Fall 93	15	13	(46)	0						
Spring 94	52	22	(30)	1						
Total	67	35	(34)	1	103	3	1	0	4	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

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

Table 2 Hunting pressure[a] and mortality[b] of brown bear by major geographic areas in Unit 4, regulatory years 1992–1996

Hunt Area	Year	Nr Hunters	M	(%)[c]	F	(%)[c]	Unknown	(%)[d]	Total harvest	% of estimated population[e]
NECCUA										
	1992	55	15	(63)	9	(38)	0		24	4.0
	1993	31	9	(90)	1	(10)	0		10	1.7
	1994	44	21	(91)	2	(9)	0		23	3.8
	1995	27	8	(53)	7	(47)	0		15	2.5
Remainder of Chichagof Island										
	1992	90	20	(67)	10	(33)	0		30	2.7
	1993	65	20	(67)	10	(33)	0		30	2.7
	1994	68	20	(65)	11	(35)	0		31	2.8
	1995	63	28	(74)	11	(26)	1	(3)	40	3.6
Baranof and Kruzof Islands										
	1992	66	16	(80)	4	(20)	0		20	2.0
	1993	60	15	(83)	3	(17)	1	(5)	19	1.9
	1994	67	15	(71)	6	(29)	0		21	2.1
	1995	67	20	(61)	12	(39)	1	(3)	33	2.9
Admiralty Island										
	1992	138	40	(71)	16	(29)	1	(2)	57	3.2
	1993	131	26	(54)	22	(46)	0		48	2.7
	1994	148	31	(72)	12	(28)	0		43	2.4
	1995	124	38	(76)	12	(24)	1	(2)	51	3.0
Unit 4 Totals										
	1992	349	91	(70)	39	(30)	1	(1)	131	2.9
	1993	287	70	(64)	36	(34)	1	(1)	107	2.4
	1994	327	87	(74)	31	(26)	0		118	2.6
	1995	291	94	(68)	42	(30)	3	(2)	139	3.1

[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.

Table 3 Unit 4 brown bear successful hunter residency, 1991–95

Regulatory year	Local resident[a]	(%)	Non-local resident	(%)	Nonresident	(%)	Total successful hunters
1991/92	22	(18)	31	(25)	71	(57)	124
1992/93	9	(7)	40	(33)	74	(60)	123
1993/94	11	(11)	23	(22)	69	(67)	103
1994/95	11	(10)	27	(24)	73	(66)	111
1995/96	17	(14)	24	(19)	83	(67)	124

[a] Resident of Unit 4.

Table 4 Unit 4 hunting effort by residency, fall 1992–spring 1996

Hunt	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
NECCUA									
	Spring 1993	29	17	46	113	96	229	18	13
	Spring 1994	11	20	31	43	111	154	8	19
	Spring 1995	33	17	50	89	105	194	20	10
	Spring 1996	14	12	26	72	50	122	12	10
Outside drainages									
	Fall 1992	22	8	30	72	35	107	8	13
	Spring 1993	25	12	37	73	78	151	9	17
	Fall 1993	23	11	34	85	63	148	9	16
	Spring 1994	11	16	27	44	74	118	9	13
	Fall 1994	20	3	23	93	24	117	3	39
	Spring 1995	16	20	36	24	147	171	15	11
	Fall 1995	28	3	32	85	32	117	9	13
	Spring 1996	13	20	33	24	147	171	15	11
Inside drainages									
	Fall 1992	59	29	88	261	147	408	23	18
	Spring 1993	82	66	148	424	365	789	65	12
	Fall 1993	35	29	64	163	206	369	19	19
	Spring 1994	77	54	131	416	357	773	58	13
	Fall 1994	53	21	74	256	133	389	16	24
	Spring 1995	123	74	197	712	500	1212	76	16
	Fall 1995	41	24	65	143	99	242	25	10
	Spring 1996	91	70	161	365	389	754	75	10
Unit 4 Totals									
	Fall 1992	81	37	118	333	182	515	31	17
	Spring 1993	136	95	231	630	539	1169	92	13
	Fall 1993	58	40	98	248	269	517	28	18
	Spring 1994	99	90	189	503	542	1045	75	14
	Fall 1994	67	22	89	334	137	471	19	25
	Spring 1995	147	91	238	787	607	1394	92	15
	Fall 1995	68	26	94	228	129	357	34	11
	Spring 1996	99	90	189	389	536	925	90	10

Table 5 Unit 4 brown bear harvest chronology, 1991–95[a]

Regulatory year	Harvest period 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
1991/92	13	14	6	1	3	1	1	1	1	0	0
1992/93	16	9	3	1	0	0	1	1	0	0	0
1993/94	13	5	4	2	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

	Harvest period 4/1-4/10	4/11-4/20	4/21-4/30	5/1-5/10	5/11-5/20	5/21-5/31	*n*
1991/92	0	0	6	26	43	8	124
1992/93	0	2	8	33	43	6	123
1993/94	1	0	5	38	27	5	103
1994/95	0	1	1	36	43	10	111
1995/96	1	1	10	33	35	10	124

[a] Includes all hunts.

Table 6 Unit 4 brown bear harvest by transport method, 1991–1995[a]

Regulatory year	Harvest						
	Airplane	Boat	3- or 4-wheeler	Walked	ORV	Highway vehicle	Unknown
1991/92	11	108			1	2	2
1992/93	13	104		3		3	
1993/94	8	89		2		4	
1994/95	10	97		1		3	1
1995/96	8	112		2		2	

[a] Registration permit data and sealing certificate data often differ. Registration permit data use.

LOCATION

GAME MANAGEMENT UNIT: 5 (6,200 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 some 300 to 500 years ago. Like many other species of wildlife, brown bears gained access to the eastern gulf coast by moving from the interior of Alaska/Canada via the Alsek/Tatshenshini corridor.

Since 1961 when brown bears were first sealed in Alaska, 803 sport-killed bears have been sealed from Unit 5 (685 from Subunit 5A and 118 from 5B). Sixty-five percent of these bears were males, and nonresident hunters took 63% of them. An additional 58 bears have been taken in situations other than legal hunts.

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

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

- Maintain a male to female harvest ratio of at least 3:2
- Sustain an average age of harvested males of at least 6.5 years
- Establish long-term objectives in a regional strategic brown bear management plan

METHODS

We gathered most data from the sealing of brown bear hides by department personnel and Division of Fish and Wildlife Protection staff. State game regulations require that brown bear hides and skulls be sealed within 30 days of harvest. The skull is measured and a pre-molar tooth extracted for age determination. Additional information is collected from the hunter, such as harvest date and location, transportation method, number of days hunted, and guide information. We collected additional information from people 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 that the population is probably stable. However, the highest kill on record occurred in 1991 and the harvest in 1992

was only 1 animal less. Since that time, the harvest has declined to about 30 bears, closer to the long-term average. Although average age and male skull size decreased slightly during the years of higher harvest, now those measures are near the 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 the 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 a metal locking tag or for sealing the bear. 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 records began. The average kill from 1971 to 1980 was 21 bears, with a range of 13–28, while the 1981–90 mean harvest was 30 animals, ranging from 23–33 bears. Since then, the annual average 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 as harvests have increased in the present decade (1990s average = 6.4 years). Average male skull size has leveled off (1990s average = 22.6 inches), after increasing between the 2 earlier decades (1970s average = 20.1 inches; 1980s average = 22.6 inches). See Table 1 for a summary of Unit 5 brown bear harvests since 1989.

During the 1994 season 22 males and 6 females were reported taken (Table 1). Females made up 21% of the total harvest. Average male skull size was 23.0 inches, slightly larger than the prior 5-year average (22.4 inches). The average age of male bears was a full year below our management objective of 6.5 years.

In 1995 hunters killed 24 males and 7 females (Table 1). Females composed 23% of the harvest. Mean male skull size was 23.5 inches, and the average age of male bears rebounded from the previous year to a value that meets our management objective. The reasons for the oscillations in these figures over the past few years are unknown. Since there is not a registration permit required in this area, we cannot measure variations in hunter effort or success. One possibility is that hunters were more selective and targeted older bears in 1995.

Hunter Residency and Success. From 1989 through 1993 nonresident hunters took an average of 77% of the Unit 5 brown bear harvest (Table 3). During the reporting period, nonresidents took an even more dominant role, taking 24 bears (86% of the harvest) in 1994 and 25 bears (81%) in 1995.

Harvest Chronology. From 1989–93 the average proportion of brown bears taken in the spring was 47% (Table 2). In 1994 17 of 28 kills (61%) took place in spring. In 1995 18 of the 31 kills (58%) were in spring.

Transport Methods. Transportation types used in successful 1994 hunts included aircraft (57%), boats (21%), highway vehicles (4%), and foot (14%). In 1995 aircraft were used in 74% of successful brown bear hunts, while the use of boats declined to 13%. Hunts using other forms of land transportation, including snowmobile, highway vehicle, and foot, accounted for the remaining 10%, although most of those involved the use of a highway vehicle.

CONCLUSIONS AND RECOMMENDATIONS

Unit 5 brown bear age objectives were not met in the first year of the report period. The average male bear age fell 1 year below the objective of 6.5 years. Bears were harvested in a male:female ratio of 7.3:2, meeting the management goal. In 1993 both objectives were met, with the average age of male bears reaching 6.7 years and the sex ratio of the harvest above the target at 6.9:2.

Brown bear harvests in Unit 5 have stabilized at a level lower than the all-time highs seen in 1991 and 1992. With no population information available, it is difficult to determine the effects of the high harvests of those years. Although the numbers have fluctuated, we may be taking a higher percentage of breeding-age sows in our female harvest because the average age has climbed. We will continue to monitor the indicators that we collect at sealing to detect trends in harvested bears. If the period of low harvests from 1993 to 1995 proves to be an anomaly and the trend toward higher hunting mortality resumes, a more conservative approach to hunting brown bears in Unit 5 may be required. If federal subsistence hunting regulations stimulate additional harvest, a conservative approach would be even more practical. On the other hand, if low harvests persist with a dearth of bears in the younger age classes, we may be dealing with weak or failed age classes. Implementation of a registration permit would allow us to assess hunter effort and success.

When black and brown bears are near residences in Yakutat, residents view bears as pests. The Yakutat dump has been an attractant to bears for many years 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.

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Table 1 Unit 5 brown bear harvest, age, skull sizes, and effort, 1986–1995

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
Mean	24.1	8.9	1.5[a]	33.4	6.3	5.4	6.0	22.6	20.7	4.3	4.4

[a] Average excludes years when no bears of unknown sex were recorded.

Table 2 Unit 5 brown bear harvest chronology, 1989–1995

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
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

Table 3 Unit 5 hunter residency, 1989–1995

Regulatory Year		Local Resident	(%)	Nonlocal Resident	(%)	Nonresident	(%)
1989	Fall	2	(7)	1	(3)	11	(38)
	Spring	1	(3)	1	(3)	13	(45)
	Total	3	(10)	2	(7)	24	(83)
1990	Fall	6	(17)	1	(3)	11	(31)
	Spring	0	(0)	0	(0)	17	(49)
	Total	6	(17)	1	(3)	28	(80)
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)

Table 4 Unit 5 transport modes used by successful hunters, 1989–1995

Regulatory Year	Air-plane	(%)	Horse/Dog team	(%)	Boat	(%)	3- or 4 wheeler	(%)	Snow-mobile	(%)	ORV	(%)	Highway vehicle	(%)	Foot	(%)	Other	(%)
1989	16	(55)	0	(0)	11	(38)	0	(0)	0	(0)	0	(0)	1	(3)	0	(0)	1	(3)
1990	26	(74)	0	(0)	5	(14)	0	(0)	0	(0)	0	(0)	1	(3)	1	(3)	2	(6)
1991	22	(54)	0	(0)	9	(22)	0	(0)	0	(0)	4	(10)	0	(0)	2	(5)	4	(10)
1992	22	(55)	0	(0)	10	(25)	0	(0)	0	(0)	0	(0)	4	(10)	3	(8)	1	(3)
1993	19	(63)	0	(0)	7	(23)	0	(0)	0	(0)	0	(0)	0	(0)	4	(13)	0	(0)
1994	16	(57)	0	(0)	6	(21)	0	(0)	0	(0)	0	(0)	1	(4)	4	(14)	1	(4)
1995	23	(74)	0	(0)	4	(13)	0	(0)	1	(3)	0	(0)	2	(6)	1	(3)	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 all islands in Unit 6D. Distribution in Unit 6D appears unchanged from that observed by Heller (1910).

We monitor harvest through mandatory sealing, which began in 1961. Total annual take 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). From 1987–1992, 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.

Logging significantly threatens brown bear abundance and distribution. Extensive clearcutting of old-growth timber on private and state land is in progress or planned in Units 6A, 6B and 6D. 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 mortality (McLellan and Shackleton 1988, Smith and VanDaele 1989).

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

Staff estimated the number of bears using methods developed by Griese (1991), Miller (1988) and Grauvogel (1990). We quantified the amount of habitat within major drainages and estimated the bear density in each major drainage. We calculated the number of bears by multiplying the bear density by habitat area and summing the results to obtain population estimates for the unit, subunits, and harvest areas within subunits. Bear habitat was defined as nonglaciated land below the 3,000-ft elevation. Density estimates were based on local knowledge and previous estimates in Unit 6 (Griese 1991, Campbell and Griese 1987).

Annual allowable harvest (AAH) of all bears was estimated as 5% of the total population. 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 by Miller (1988, 1990) for ideal conditions.

I estimated the total harvest by adding reported harvest and estimated illegal kill. Data were summarized for 11 harvest areas, each with similar biogeographic and harvest characteristics.

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 skull size, sex, age, date and location of kill, hunter residency, method of transportation, and number of days in the field. Unsuccessful hunters were not required to report. I estimated the illegal kill using local reports and observations.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Estimated population in Unit 6 was 796 bears (Table 1). The greatest numbers were in Units 6A (272) and 6D (283), followed by Units 6B (129) and 6C (112). Bear numbers over the past 5 years increased in Units 6A (+10%), 6B (+12%), and 6C (+10%) (Table 1). In Unit 6D the population declined during 1991–93 because of excessive harvests. Lower harvest during the past 2 years has allowed the population to stabilize.

Montague Island in Unit 6D had an increasing population of 45 bears. 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 very low. Historically, it probably had much higher numbers. However, overharvest that began in the 1970s probably reduced the population (Griese 1990) and threatened its viability. Inbreeding in small, isolated populations, such as Montague Island, reduces genetic variability and may increase the danger of extinction (Mills and Smouse 1994, Randi et al. 1994).

Our density estimates for Unit 6 compared favorably to Miller's (1993*a*) estimates from elsewhere in south coastal Alaska. Hinchinbrook Island was within a high-density range (>175 bears/1,000 km^2) that included Kodiak Island, much of the Alaska Peninsula, and parts of Southeast Alaska. Montague Island, eastern Prince William Sound (PWS), and the north gulf coast were midrange density (40 to 175 bears/1,000 km^2), consistent with contiguous coastal habitat to the southeast and with the northern Alaska Peninsula. Western PWS was low-density (<40 bears/1,000 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–30 May. The Unit 6D season, except Montague Island, was 15 October–15 May for all hunters. The bag limit was 1 bear every 4 regulatory years. 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 1994–95 and 1995–96 for Unit 6 was 34 and 32, respectively (Table 1). Most bears were taken from Units 6A and 6D, where 10 to 12 bears were taken annually from each unit. Unit harvest was lower than in 1991–92 and 1992–93 because the season in Unit 6D during the current reporting period was 30 days shorter. Unit harvest was higher than 1993–94 because unusually cold temperatures during spring 1994 delayed bear emergence from dens, reducing the availability of bears all across the unit. Miller (1989)

documented a correlation between late exits from dens and colder weather with persistent snow cover.

During 1994–95 and 1995–96, males were 64% and 69% of the reported kill by hunters (Table 2), and mean skull sizes among males were 24 inches and 23 inches (Table 3), respectively. Both were similar to most values during the past 5 years. The exception was 71% males in the harvest during 1993–94, which was the highest value in the last 5 years. A cold spring that year reduced the availability of all bears, however, most of the active bears were probably males because they tend to exit from dens first. Miller (1989) and VanDaele et al. (1989) reported this chronology elsewhere in Southcentral Alaska.

Reported kill of all bears during this reporting period equaled or was less than AAH in 6 of 11 harvest areas (Table 1). Harvest exceeded AAH by only 1 or 2 bears in each of the other 5 areas. Reported kill of females > 2 years old equaled or was less than AAH in 10 of 11 harvest areas. It exceeded AAH by 1 bear in only 1 area.

I believe the 5% harvest rate applied in Unit 6 is sustainable. Harvest rates for all bears of 21.6% in Unit 13E and 5.3% in Unit 20A (Miller 1993a) caused populations to decline in portions of those subunits (Reynolds 1993, Miller 1993b). A 5% sustainable harvest rate in Unit 13E was recommended (Miller 1993b). Recommended and reported harvest rates from across North America were 2% to 7% (LeFranc 1987). In the Yukon, sustainable harvest of 2% to 3% and a total man-caused mortality of <10% was recommended (Sidorowicz and Gilbert 1981).

AAH for all bears on Montague Island was 2 and was not exceeded during the past 5 years. Greatest reported take was 1 per year. However, deer hunters probably took additional bears during the fall that were not reported or were reported taken in adjacent units. About 500 deer hunters visit the island annually, and conflicts between deer hunters and bears can be a major source of bear mortality (Smith et al. 1989).

Hunter Residency. Nonresidents harvested most of the bears in Unit 6 during 1994–95 (58%) and 1995–96 (56%) (Table 4). In Units 6C and 6D local and nonlocal residents of Alaska took the highest proportion of the harvest. This occurred because these subunits were more accessible by road or boat and attracted more resident hunters. This harvest pattern was unchanged over the past 5 years.

Harvest Chronology. Most bears were taken in Unit 6 during May (31% in 1994–95 and 47% in 1995–96) (Table 5). September and October were also important harvest periods. This was also the pattern among subunits during this reporting period and over the past 5 years.

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 were important, along with aircraft, because the relatively sheltered waters of Prince William Sound allow use of small boats. These patterns were typical of the past 5 years.

Other Mortality

In 1994–95 nonhunting and estimated illegal kill was 15 bears; in 1995–96 nonhunting and estimated illegal kill was 9 bears (Table 2). The total for 1994–95 was the highest in the last 5 years. Nonhunting kills accounted for most of the difference; causes for these kills are unknown. The total for 1995–96 was typical of past years.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Timber harvesting was in progress or planned in brown bear habitat in all units, except 6C. Logging on private land in Unit 6D was of particular concern. In the Rude River–Ellamar area, large clearcuts were completed near Two Moon Bay and Fish Bay. Logging operations were begun in Nelson and Simpson bays. As logging increases, brown bear habitat quality will decline, access will improve, and nonhunting mortality will increase. Bear numbers are already depressed due to previous excessive hunter harvests, and additional mortality associated with timber management will certainly affect the unit's brown bear population.

CONCLUSIONS AND RECOMMENDATIONS

Management objectives were achieved. 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 and management strategies were appropriate. I recommend no changes. In Unit 6D the population declined from 1991 to 93 because of excessive harvests. Lower harvest during the past 2 years has allowed the population to stabilize or increase slightly. Montague Island should remain closed. The population was very low and cannot sustain hunter harvest until numbers increase to at least 80 bears. In the remainder of Unit 6D, careful harvest monitoring should continue, and a permit hunt should be considered if harvest increases.

Logged areas unitwide should be given special attention. Bear harvests should be closely monitored, particularly nonhunting and illegal kills. The cumulative effects of timber management should be assessed to determine effects on the bear population. Contractors should be monitored to assure operator compliance with guidelines for handling garbage and other attractants, and education/enforcement actions should be taken as necessary.

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Table 1 Unit 6 brown bear estimated population, annual allowable harvest and reported harvest, 1991–95

Unit	Area	Regulatory year	Density (bears/ 1,000 sq km)	Nr. of 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-	1991/92	83	154	8	3	3	2
	Cape Suckling	1992/93	85	159	8	6	3	1
		1993/94	88	163	8	2	3	0
		1994/95	90	168	8	7	3	2
		1995/96	93	172	9	5	3	0
	Cape Suckling-	1991/92	61	85	4	7	2	2
	Katalla	1992/93	61	85	4	6	2	2
		1993/94	63	87	4	4	2	1
		1994/95	65	90	5	3	2	0
		1995/96	67	93	5	6	2	1
	Kayak Island	1991/92	78	7	0	0	0	0
		1992/93	78	7	0	0	0	0
		1993/94	78	7	0	0	0	0
		1994/95	78	7	0	0	0	0
		1995/96	78	7	0	0	0	0
6A Total		1991/92	74	246	12	10	5	4
		1992/93	75	251	12	12	5	3
		1993/94	77	257	12	6	5	1
		1994/95	80	265	13	10	5	2
		1995/96	82	272	14	11	5	1

Table 1 Continued

Unit	Area	Regulatory year	Density (bears/ 1,000 sq km)	Nr. of bears	Annual allowable harvest (all bears)	Reported harvest (all bears)	Annual allowable harvest (F>2 yr old)	Reported harvest (F>2 yr old)
6B		1991/92	107	115	6	8	2	3
		1992/93	110	118	6	4	2	0
		1993/94	113	122	6	1	2	1
		1994/95	117	126	6	6	3	2
		1995/96	120	129	6	5	3	2
6C		1991/92	91	101	5	8	2	2
		1992/93	95	106	5	2	2	0
		1993/94	95	106	5	0	2	0
		1994/95	98	109	5	6	2	1
		1995/96	101	112	6	5	2	3
6D	Rude River-Ellamar	1991/92	75	93	5	13	2	3
		1992/93	68	85	4	11	2	4
		1993/94	63	78	4	10	2	3
		1994/95	63	78	4	3	2	1
		1995/96	63	78	4	6	2	0
	Valdez Arm	1991/92	37	35	2	1	1	0
		1992/93	39	36	2	3	1	1
		1993/94	39	36	2	0	1	0
		1994/95	39	36	2	3	1	1
		1995/96	39	36	2	1	1	0

Table 1 Continued

Unit	Area	Regulatory year	Density (bears/ 1,000 sq km)	Nr. of 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	1991/92	-	17	1	1	0	1
		1992/93	-	17	1	1	0	0
		1993/94	-	17	1	0	0	0
		1994/95	-	17	1	0	0	0
		1995/96	-	17	1	0	0	0
	Hinchinbrook Island	1991/92	246	98	5	7	2	2
		1992/93	241	96	5	10	2	2
		1993/94	224	90	4	5	2	0
		1994/95	224	90	4	5	2	1
		1995/96	224	90	4	4	2	1
	Hawkins Island Island	1991/92	9	16	1	2	0	0
		1992/93	8	15	1	0	0	0
		1993/94	89	15	1	0	0	0
		1994/95	89	15	1	0	0	0
		1995/96	98	17	1	0	0	0
6D Total Without Montague Island		1991/92	-	259	14	24	5	6
		1992/93	-	249	13	25	5	7
		1993/94	-	236	12	15	5	3
		1994/95	-	236	12	11	5	3
		1995/96	-	238	12	11	5	1

Table 1 Continued

Unit	Area	Regulatory year	Density (bears/ 1,000 sq km)	No. of bears	Annual allowable harvest (all bears)	Reported harvest (all bears)	Annual allowable harvest (F>2 yr old)	Reported harvest (F>2 yr old)
6D	Montague Island	1991/92	54	41	2	1	1	0
		1992/93	54	41	2	1	1	0
		1993/94	54	41	2	0	1	0
		1994/95	57	43	2	1	1	0
		1995/96	60	45	2	0	1	0
6D Total		1991/92	-	300	16	25	6	6
		1992/93	-	290	15	6	6	7
		1993/94	-	277	14	15	6	3
		1994/95	-	279	14	12	6	3
		1995/96	-	283	14	11	6	1
Unit 6 Total		1991/92	-	762	39	51	15	15
		1992/93	-	765	38	44	15	10
		1993/94	-	762	37	22	15	5
		1994/95	-	779	38	34	16	8
		1995/96	-	796	40	32	16	7

Table 2 Unit 6 brown bear harvest, 1991–95

		Reported								Estimated						
	Regulatory	Hunter kill					Nonhunting				Total estimated kill					
Unit	year	M	F	(%)	Unk.	Total	M	F	Unk.	kill	M	(%)	F	(%)	Unk.	Total
6A	1991/92															
	Fall 91	2	3	(60)	0	5	0	0	0	1	2	(40)	3	(60)	0	6
	Spring 92	3	2	(40)	0	5	0	0	0	0	3	(60)	2	(40)	0	5
	Total	5	5	(50)	0	10	0	0	0	1	5	(50)	5	(50)	0	11
	1992/93															
	Fall 92	5	5	(50)	0	10	0	0	0	1	5	(50)	5	(50)	0	11
	Spring 93	2	0	(0)	0	2	0	0	0	0	2	(100)	0	(0)	0	2
	Total	7	5	(42)	0	12	0	0	0	1	7	(58)	5	(42)	0	13
	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)	0	5
	Total	3	2	(40)	0	5	0	1	0	1	3	(50)	3	(50)	0	7
	1994/95															
	Fall 94	2	2	(50)	1	5	0	2	0	1	2	(33)	4	(67)	1	6
	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)	0	9
	1995/96															
	Fall 95	5	2	(29)	0	7	0	0	0	1	5	(71)	2	(29)	0	8
	Spring 96	4	0	(0)	0	4	0	0	0	1	4	(100)	0	(0)	0	5
	Total	9	2	(18)	0	11	0	0	0	2	9	(82)	2	(18)	0	13

Table 2 Continued

Unit	Regulatory year	Reported								Estimated						
		Hunter kill					Nonhunting				Total estimated kill					
		M	F	(%)	Unk.	Total	M	F	Unk.	kill	M	(%)		(%)	Unk.	Total
6B	1991/92															
	Fall 91	1	3	(75)	0	4	0	0	0	1	1	(25)	3	(75)	0	5
	Spring 92	2	2	(50)	0	4	0	0	0	0	2	(50)	2	(50)	0	4
	Total	3	5	(63)	0	8	0	0	0	1	3	(38)	5	(63)	0	9
	1992/93															
	Fall 92	1	1	(50)	0	2	0	0	0	1	1	(50)	1	(50)	0	3
	Spring 93	2	0	(0)	0	2	0	0	0	0	2	(100)	0	(0)	0	2
	Total	3	1	(25)	0	4	0	0	0	1	3	(75)	1	(25)	0	5
	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)	0	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)	0	7
	1995/96															
	Fall 95	1	2	(67)	0	3	0	0	0	1	1	(33)	2	(67)	0	4
	Spring 96	1	1	(50)	0	2	0	0	0	1	1	(50)	1	(50)	0	3
	Total	2	3	(60)	0	5	0	0	0	2	2	(40)	3	(60)	0	7

Table 2 Continued.

Unit	Regulatory year	Reported								Estimated	Total estimated kill					
		Hunter kill					Nonhunting									
		M	F	(%)	Unk.	Total	M	F	Unk.	kill	M	(%)		(%)	Unk.	Total
6C	1991/92															
	Fall 91	2	0	(0)	0	2	0	2	0	1	2	(50)	2	(50)	0	5
	Spring 92	3	1	(25)	0	4	0	0	0	1	3	(75)	1	(25)	0	5
	Total	5	1	(17)	0	6	0	2	0	2	5	(63)	3	(38)	0	10
	1992/93															
	Fall 92	1	1	(50)	0	2	0	0	0	0	1	(50)	1	(50)	0	2
	Spring 93	0	0	(0)	0	0	0	0	0	0	0	(0)	0	(0)	0	0
	Total	1	1	(50)	0	2	0	0	0	0	1	(50)	1	(50)	0	2
	1993/94															
	Fall 93	0	0	(0)	0	0	0	0	0	1	0	(0)	0	(0)	0	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)	0	1
	1994/95															
	Fall 94	2	3	(60)	0	5	0	0	0	1	2	(40)	3	(60)	0	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)	0	7
	1995/96															
	Fall 95	1	2	(67)	0	3	0	0	0	1	1	(33)	2	(67)	0	4
	Spring 96	1	1	(50)	0	2	0	0	0	1	2	(50)	1	(50)	0	3
	Total	2	3	(60)	0	5	0	0	0	2	3	(40)	3	(60)	0	7

Table 2 Continued

Unit	Regulatory year	Reported: Hunter kill M	F	(%)	Unk.	Total	Reported: Nonhunting M	F	Unk.	Estimated kill	Total estimated kill M	(%)		(%)	Unk.	Total
6D	1991/92															
	Fall 91	8	4	(33)	0	12	0	0	1	3	8	(67)	4	(33)	1	16
	Spring 92	8	4	(33)	0	12	0	0	0	1	8	(67)	4	(33)	0	13
	Total	16	8	(33)	0	24	0	0	1	4	1	(67)	8	(33)	1	29
	1992/93															
	Fall 92	5	4	(44)	0	9	2	2	0	2	7	(54)	6	(46)	0	15
	Spring 93	10	3	(23)	0	13	0	0	0	1	1	(77)	3	(23)	0	14
	Total	15	7	(32)	0	22	2	2	0	3	1	(65)	9	(35)	0	29
	1993/94															
	Fall 93	5	1	(17)	0	6	0	0	0	2	5	(83)	1	(17)	0	8
	Spring 94	7	2	(22)	0	9	0	0	0	1	7	(78)	2	(22)	0	10
	Total	12	3	(20)	0	15	0	0	0	3	1	(80)	3	(20)	0	18
	1994/95															
	Fall 94	1	1	(50)	0	2	1	1	0	3	2	(50)	2	(50)	0	7
	Spring 95	3	1	(25)	0	4	2	1	1	1	4	(80)	1	(20)	1	7
	Total	4	2	(33)	0	6	3	2	1	4	6	(67)	3	(33)	1	14
	1995/96															
	Fall 95	2	0	(0)	0	2	0	0	0	1	2	(100)	0	(0)	0	3
	Spring 96	7	2	(22)	0	9	0	0	0	2	7	(78)	2	(22)	0	11
	Total	9	2	(18)	0	11	0	0	0	3	9	(82)	2	(18)	0	14

Table 2 Continued

Unit	Regulatory year	Reported								Estimated	Total estimated kill					
		Hunter kill					Nonhunting									
		M	F	(%)	Unk.	Total	M	F	Unk.	kill	M	(%)		(%)	Unk.	Total
Unit 6 Total	1991/92															
	Fall 91	13	10	(43)	0	23	0	2	1	6	1	(52)	12	(48)	1	32
	Spring 92	16	9	(36)	0	25	0	0	0	2	1	(64)	9	(36)	0	27
	Total	29	19	(40)	0	48	0	2	1	8	2	(58)	21	(42)	1	59
	1992/93															
	Fall 92	12	11	(48)	0	23	2	2	0	4	1	(52)	13	(48)	0	31
	Spring 93	14	3	(18)	0	17	0	0	0	1	1	(82)	3	(18)	0	18
	Total	26	14	(35)	0	40	2	2	0	5	2	(64)	16	(36)	0	49
	1993/94															
	Fall 93	6	2	(25)	0	8	0	0	0	3	6	(75)	2	(25)	0	11
	Spring 94	9	4	(31)	0	13	0	1	0	2	9	(64)	5	(36)	0	16
	Total	15	6	(29)	0	21	0	1	0	5	1	(68)	7	(32)	0	27
	1994/95															
	Fall 94	5	6	(55)	1	12	1	3	0	6	6	(40)	9	(60)	1	22
	Spring 95	11	3	(21)	0	14	2	1	1	1	1	(76)	3	(24)	1	19
	Total	16	9	(36)	1	26	3	4	1	7	1	(59)	12	(41)	2	41
	1995/96															
	Fall 95	9	6	(40)	0	15	0	0	0	4	9	(60)	6	(40)	0	19
	Spring 96	13	4	(24)	0	17	0	0	0	5	1	(76)	4	(24)	0	22
	Total	22	10	(31)	0	32	0	0	0	9	2	(69)	10	(31)	0	41

Table 3 Unit 6 brown bear mean skull size and age, 1991–95

		Males				Females			
Unit	Year	Skull size	*n*	Age	*n*	Skull size	*n*	Age	*n*
6A	1991/92	25	5	10	5	19	5	6	5
	1992/93	21	7	3	7	21	4	8	4
	1993/94	21	3	3	2	21	2	5	2
	1994/95	24	5	6	5	23	2	15	2
	1995/96	24	9	7	8	22	2	4	2
6B	1991/92	24	3	9	3	21	5	8	5
	1992/93	22	3	3	3	19	1	2	1
	1993/94	-	0	-	0	23	1	15	1
	1994/95	24	4	7	4	23	1	10	1
	1995/96	25	2	3	1	21	3	4	3
6C	1991/92	24	4	8	5	22	1	4	1
	1992/93	23	1	4	1	24	1	-	0
	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
6D	1991/92	23	16	6	15	21	8	7	8
	1992/93	23	15	8	14	21	7	6	6
	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

Table 3 Continued

		Males				Females			
Unit	Year	Skull size	*n*	Age	*n*	Skull size	*n*	Age	*n*
Unit 6	1991/92	24	28	7	28	21	19	7	19
Total	1992/93	22	26	6	25	21	13	7	11
	1993/94	24	14	9	14	22	6	8	6
	1994/95	24	15	6	16	22	8	10	8
	1995/96	23	22	6	20	21	10	5	10

Table 4 Unit 6 brown bear successful hunter residency, 1991–95

Unit	Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Residency unknown	(%)	Total Successful hunters
6A	1991/92	0	(0)	1	(10)	9	(90)	0	(0)	10
	1992/93	1	(8)	4	(33)	7	(58)	0	(0)	12
	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
6B	1991/92	2	(25)	1	(13)	5	(63)	0	(0)	8
	1992/93	1	(25)	0	(0)	3	(75)	0	(0)	4
	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
6C	1991/92	3	(50)	2	(33)	1	(17)	0	(0)	6
	1992/93	1	(50)	1	(50)	0	(0)	0	(0)	2
	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
6D	1991/92	3	(13)	12	(50)	9	(38)	0	(0)	24
	1992/93	3	(14)	11	(50)	8	(36)	0	(0)	22
	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

Table 4 Continued

Unit	Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Residency unknown	(%)	Total successful hunters
Unit 6	1991/92	8	(17)	16	(33)	24	(50)	0	(0)	48
Total	1992/93	6	(15)	16	(40)	18	(45)	0	(0)	40
	1993/94	3	(14)	7	(33)	10	(48)	1	(5)	21
	1994/95	3	(12)	8	(31)	15	(58)	0	(0)	26
	1995/96	8	(25)	6	(19)	18	(56)	0	(0)	32

[a] Resident of Unit 6

Table 5 Unit 6 brown bear harvest chronology percent, 1991–95

Unit	Regulatory year	Harvest periods										
		September		October		November		April		May		
		1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–30	1–15	16–31	*n*
6A	1991/92	30	20	0	0	0	0	0	30	20	0	10
	1992/93	58	25	0	0	0	0	0	0	17	0	12
	1993/94	20	20	0	0	0	0	0	0	40	20	5
	1994/95	50	0	13	0	0	0	0	25	13	0	8
	1995/96	36	18	9	0	0	0	0	9	18	9	11
6B	1991/92	0	38	13	0	0	0	0	13	13	25	8
	1992/93	25	0	0	25	0	0	0	0	50	0	4
	1993/94	0	0	0	0	0	0	0	100	0	0	1
	1994/95	0	0	0	0	0	0	0	50	50	0	6
	1995/96	40	20	0	0	0	0	0	0	20	20	5
6C	1991/92	17	0	0	17	0	0	0	17	33	17	6
	1992/93	0	50	0	0	50	0	0	0	0	0	2
	1993/94	0	0	0	0	0	0	0	0	0	0	0
	1994/95	0	33	50	0	0	0	0	0	0	17	6
	1995/96	20	0	40	0	0	0	0	0	0	40	5
6D	1991/92	13	13	13	8	4	0	0	0	25	25	24
	1992/93	5	0	23	14	0	0	0	0	32	27	22
	1993/94	0	0	20	13	0	7	0	0	33	27	15
	1994/95	0	0	0	33	0	0	17	0	50	0	6
	1995/96	0	0	0	9	9	0	0	9	64	9	11

Table 5 Continued

Unit	Regulatory year	Harvest periods										
		September		October		November		April		May		
		1–15	16–30	1–15	16–31	1–15	16–30	1–15	16–30	1–15	16–31	*n*
Unit 6	1991/92	15	17	8	6	2	0	0	10	23	19	48
Total	1992/93	23	10	13	10	3	0	0	0	28	15	40
	1993/94	5	5	14	10	0	5	0	5	33	24	21
	1994/95	15	8	15	8	0	0	4	19	27	4	26
	1995/96	22	9	9	3	3	0	0	6	31	16	32

Table 6 Unit 6 brown bear harvest percent by transport method, 1991–95

Unit	Regulatory year	Percent of harvest						*n*
		Airplane	Boat	3- or 4-wheeler	ORV	Highway vehicle	Unknown	
6A	1991/92	100	0	0	0	0	0	10
	1992/93	91	9	0	0	0	0	11
	1993/94	100	0	0	0	0	0	5
	1994/95	100	0	0	0	0	0	8
	1995/96	91	9	0	0	0	0	11
6B	1991/92	38	0	0	0	50	13	8
	1992/93	75	0	0	0	25	0	4
	1993/94	100	0	0	0	0	0	1
	1994/95	100	0	0	0	0	0	6
	1995/96	60	20	0	0	20	0	5
6C	1991/92	0	33	0	0	67	0	6
	1992/93	50	0	0	0	50	0	2
	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
6D	1991/92	25	67	0	0	0	8	24
	1992/93	41	59	0	0	0	0	22
	1993/94	33	60	0	0	7	0	15
	1994/95	50	50	0	0	0	0	6
	1995/96	27	3	0	0	0	0	11

Table 6 Continued

Unit	Regulatory year	Percent of harvest						*n*
		Airplane	Boat	3- or 4-wheeler	ORV	Highway vehicle	Unknown	
Unit 6	1991/92	40	38	0	0	17	6	48
Total	1992/93	59	36	0	0	5	0	39
	1993/94	52	43	0	0	5	0	21
	1994/95	69	19	0	0	12	0	26
	1995/96	50	38	0	0	13	0	32

LOCATION

GAME MANAGEMENT UNITS: 7 (3,520 mi^2) and 15 (4,876 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 analysis 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 (USFS) (Chugach National Forest, ca. 2,000 mi^2) is the principle landowner in Unit 7 with the National Park Service (NPS) (Kenai Fjords National Park, ca. 885 mi^2). In Unit 15 the U.S. Fish and Wildlife Service (USFWS) (Kenai National Wildlife Refuge) is responsible for management of 3,062 mi^2. Ownership of the remainder of Unit 15 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–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. The bag limit was 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 USFWS, USFS, NPS, 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 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 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.* In Press). The IBBST is drafting an interagency brown bear management plan using guidelines provided by Jacobs (1989). 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. In Press). This project is scheduled to run through FY98.

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). A female unit harvested consists of 1 female >2 years old or 2 females <3 years old.

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 assessing suitable habitat and comparing estimates of bear density to other parts of Alaska. 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.

Miller (pers. commun.) suggested the density of brown bears on the Kenai was probably lower than 27.1 bears per 1,000 km^2 (7.0 bears per 100 mi^2) that he reported for other areas in Southcentral Alaska (1987). We estimated the bear density on the Kenai to be 20 bears per 1,000 km^2 (5.2 bears per 100 mi^2), and we calculated the suitable habitat to be 13,848 km^2 (5,347 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 listed as Appendix A.

Since 1961, a mandatory sealing program has provided information on all harvested bears, including distribution and sex–age composition.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Assuming that the brown bear density was 20 bears per 1,000 km^2 (5.2 bears per 100 mi^2) and suitable habitat was 13,848 km^2 (5,347 mi^2), we estimated the brown bear population for Units 7 and 15 at 277 brown bears.

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).

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 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 (BOG) shortened the fall brown bear season by 14 days, creating a fall opening date of 15 September. The reason for this change was to reduce the incidental take of brown bears by moose hunters. During the spring 1994 Board of Game meeting, the BOG shortened and moved the fall hunting season to 1–25 October in response to continued high harvest levels. The fall 1995 season was closed by emergency order because additional harvest from the fall season would exceed management objectives.

The department drafted a proposal to the Board of Fisheries (BOF) to close Russian Creek to fishing for the month of August to protect a brown bear concentration area. The Department of Law advised the BOF that they did not have the authority to regulate a fishery for wildlife conservation. The proposal was referred to the Joint Boards of Fisheries and Game. This proposal has been deferred until April 1997.

Hunter Harvest. Annual harvest levels continued to exceed management objectives. Twenty bears were taken during regulatory year 1994–95. Hunters harvested 6 bears (3 males and 3 females) in the fall of 1994. An additional 6 bears (2 males and 4 females) were reported in the spring of 1995 (Table 1). Eight bears (5 males and 3 females) were taken as nonsport (all defense of life or property) mortalities.

Fifteen bears were taken during regulatory year 1995–96. The fall 1995 season was closed by emergency order. Five bears (3 males and 2 females) were reported in the spring of 1996 (Table 1). There were 10 nonsport mortalities (3 males and 7 females); 9 were defense of life or property mortalities and 1 was a research mortality.

Harvest Chronology. Approximately equal numbers of bears were taken during fall and spring seasons since the 1992–93 season (Table 3). During 1995–96, however, all bears were harvested in May because the fall season was closed.

Transport Methods. Successful brown bear hunters have used all transportation methods with the exception of snowmachines during the past 5 years. In 1994 most hunters used highway vehicles (58%), horseback, and boat. In 1995 most hunters used highway vehicles (60%) and 4-wheelers (40%) (Table 4).

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

The department and other resource management agencies should implement a long-term brown bear management plan. The IBBST draft management plan will provide the framework for such a working plan. Recently, this team has expressed concern over a trend in increased brown bear mortality on the Kenai Peninsula and the potential for additional mortality from human encroachment into bear habitat.

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 forestlands for salvage cutting. Logging mature forests may affect brown bears in numerous ways, including fragmentation of forest habitat and increased human access through an extensive road system.

CONCLUSION AND RECOMMENDATIONS

The number of bears killed exceeded management objectives in 3 of the last 5 years. The number of bears taken in defense of life or property (DLP) has increased, negating effects of season reduction. 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. Under the current management objective, and as a conservative measure, we suggest using an estimated population of 250 brown bears until more reliable density data are available. Further restrictions in the fall season may be necessary to offset the increasing DLP rate.

Taylor et al. (1987) noted that survival of adult females was the predominant factor affecting population dynamics of bears. To maintain a population of 250 bears on the Kenai Peninsula, the harvest of females should not exceed 40%, or a 3-year mean annual harvest of 5.7 females. We refined the desired harvest rate quota by using the point system similar to Smith (1989) to account for young female bears (<3 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 <3 years of age were assigned only half the value of 2-year-old females.

The management objectives were revised to indicate the new 3-year mean annual harvest should not exceed 6 "female units." Using a 3-year mean avoids overreacting to abnormal harvest variations caused by weather, food availability, or changes in human–use patterns. We need to closely monitor the harvest of adult female bears, particularly during the fall season. If the mean harvest is substantially above the recommended annual quota of 6 female units, the department should curtail the harvest through emergency action. Because bears are polygamous, the number of males may not be as crucial as the number of females. In future years if the harvest of males continues to increase, we may need to set a numerical limit for both sexes. The management protocol drafted in 1995 describes specific actions to be taken (Appendix A).

The long-term health of brown bears on the Kenai Peninsula depends upon maintaining quality bear habitat. There are 2 activities that will affect bear abundance. The proposed forest management plan (Dick et al. 1992) may affect bears through the logging of mature forest stands

and the building of roads into previously inaccessible areas. 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.

We need to continue to monitor the sport and nonsport harvest by season, location, and cause to identify any tangential management issues that may affect bear mortality. Potential issues include other big game seasons that overlap with brown bear seasons, brown bears taken near 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.

The Kenai Peninsula brown bear population is essentially closed. Appreciable immigration is unlikely because the city of Anchorage is adjacent to the Kenai and the area around Turnagain Arm does not draw high brown bear densities. Because the Kenai Peninsula is essentially a closed system, areas supporting slightly higher harvests could alleviate harvest demands in the more highly impacted areas.

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Appendix A.

BROWN BEAR MANAGEMENT PROTOCOL

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 September to reduce incidental mortality of brown bears 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 or property mortality during 1994 negated the effects of the shorter season. This protocol will recommend both short- and long-term management strategies.

In 1984 representatives of the U.S. Fish and Wildlife Service, U.S. Forest Service, National Park 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. 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 mi^2), equivalent to 63% of the Kenai Peninsula land area (Del Frate 1993). Miller (pers. commun.) 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 km^2 of suitable habitat. 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 a maximum of 6 females (Del Frate 1993). Smith (1989) used a sex-weighted point system to encourage guides and outfitters to take predominantly male bears 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 out 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 maximum harvest 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 in press). These bears were assumed to have a lower "reproductive value" and therefore should not count as much as adult females. Specifically, a kill of a female bear <3 years of age was assigned a value of 0.5 female units. The new sustainable harvest rate should not exceed 5.6 "female units." This system compensates for years when hunters take more yearlings and 2-year-olds in the harvest.

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 because the Municipality of Anchorage is adjacent to the Kenai and the area around Turnagain Arm does not draw high brown bear densities. Decisions should not be made for 1 subunit that may negatively impact brown bears in other areas. Furthermore, because the Kenai is a "closed" system, areas that may be slightly underharvested can alleviate hunting pressure 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 an annual harvest objective of no more than 6 female units based on a 3-year running 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 a 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 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 are 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 in-season 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., trap and translocate, roadkill, DLP, etc.) when determining allowable harvest.

- Monitor the sport and nonsport harvest by season, location, and cause to identify 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 near 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.

RECOMMENDED ACTION FOR 1995

- 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 female units and the 5-year average was 2.3 female units. 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 female units of the 3-year quota. Three female bear units were taken in defense of life or 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 female units, we would be within 0.8 female units of the established maximum kill without considering DLPs or other nonsport kills. Therefore, I would recommend the emergency order be written after the spring season to avoid encouraging 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 number of nonsport kills this year is still in question.

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Table 1 Units 7 and 15 brown bear harvest, 1992–95

Regulatory year	Reported: Hunter Kill M	F	Unk.	Total	Reported: Nonhunting kill[a] M	F	Unk.	Total estimated kill: M	(%)	F	(%)	UNK.	(%)	Total
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

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

Table 2 Unit 7 and 15 brown bear successful hunter residency, 1985–95

Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total successful hunters[b]
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

[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, 1985–95

Regulatory year	Harvest periods			n[a]
	September	October	May	
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

[a] Does not include nonsport harvest.

Table 4 Units 7 and 15 brown bear harvest percent by transport method, 1985–95

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

[a] Does not include nonsport harvest.

LOCATION

GAME MANAGEMENT UNIT: 8 (5,097 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, 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 National Wildlife Refuge, were conveyed to Native village corporations under the Alaska Native Land Claims Settlement Act of 1971 and through the Alaska National Interest Lands Conservation Act of 1980. 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, sportfishermen, 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.

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 (USFWS) subsequently imposed a land-use permit requirement for brown bear hunting on the Kodiak National Wildlife Refuge 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 of Fish and Game 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 were 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 (EGA) to 20 guides in Unit 8 in 1975. Each guide was guaranteed access to hunting permits for clients under the EGA system, with 40% of available bear permits allocated to nonresidents.

The Alaska Supreme Court declared EGAs unconstitutional in 1988, which created an opportunity for additional licensed guides to operate 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 1994–95 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 National Wildlife Refuge to 13 guides in 1993.

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 population status and life history of the Kodiak brown bear has been underway since 1982 (Barnes 1986; 1990; Smith and VanDaele 1988; 1990; VanDaele *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 to improve educational programs for deer hunters.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

- Maintain a stable brown bear population that will sustain an annual harvest of 150 bears comprising at least 60% males
- 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
- 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, which required hunters to bring the hide and skull of each bear 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 3 study areas with the "intensive aerial survey technique" (IAS) detailed in Barnes and Smith (1997*a*) and previously reported in Smith (1995). An IAS was done cooperatively with the US Fish and Wildlife Service (USFWS) in a 286 km^2 area in the Spiridon Bay and South Arm Uganik Bay drainages of western Kodiak Island in May, 1995. In May 1996 an IAS was completed with the USFWS in eastern Kodiak Island in a

269 km^2 area north of Kiliuda Bay and in a 158 km^2 area south of Kiliuda Bay. A random line transect survey was also completed in May 1996 in a larger study area in the Kiliuda and Ugak Bay drainages.

The department continued cooperative work related to brown bear habitat and population during this reporting period. FWS staff conducted aerial brown bear composition surveys along selected streams of southern Kodiak Island each year. Cooperative studies with the FWS on sockeye salmon enhancement projects at Spiridon Lake on western Kodiak Island and at Hidden Lake on Afognak Island continued. The Hidden Lake study was terminated in 1995. We continued a cooperative study with the FWS on population ecology of brown bears, begun in 1992, in the Aliulik Peninsula.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The brown bear population is stable, and hunting has been closely regulated by permits since 1976. A slightly increasing trend in hunting mortality and nonsport mortality has occurred since the early 1970s. However, the bear population has increased in the northeastern corner of Kodiak Island since the early 1970s because of more restrictive seasons and reduced killing of bears associated with livestock. Recent estimates of the brown bear population compare closely with estimates made in the 1950s.

Population Size

We did an IAS in a 286 km^2 area in the Spiridon Bay and south arm of Uganik Bay drainages during May 23–31, 1995. We completed 4 replicate aerial surveys and observed 40 independent bears/1,000 km^2. We rated sightability at 32.8%, the same as for capture-mark-resight studies in the Terror Lake study area. We estimated the population density at 120 independent bears/1,000 km^2. Among several areas that have been surveyed since 1987, the Spiridon area ranked second lowest in estimated density. Within the Spiridon study area, bear density was lowest from Spiridon Lake west and highest near inner Uganik and Spiridon Bays.

During 19–27 May 1996, we did IAS surveys in 2 areas in eastern Kodiak Island, a 274 km^2 area in the Shearwater Peninsula between Ugak and Kiliuda Bays, and a 159 km^2 area in the peninsula between Kiliuda Bay and Sitkalidak Strait. We completed 3 replicate surveys in the Shearwater area, and we observed 92 bears/1,000 km^2. We rated sightability at 37% and estimated the population density at 248 bears/1,000 km^2. We completed 4 replicate surveys in the Kiliuda area and we observed 101 bears/1,000 km^2. We rated sightability at 37% and estimated the population density at 270 bears/1,000 km^2. Results of the IAS survey indicated that brown bear density in east-central Kodiak Island was higher than was originally estimated. The densities estimated for the Shearwater and Kiliuda areas were closely comparable to previous estimates derived from capture-mark-resight studies in southern and northwestern Kodiak Island. Results of a line transect survey in 1996 are still being analyzed.

We used results of intensive aerial surveys to revise the population estimate for Kodiak Island, increasing the estimate approximately 5% from 1664 to 1750 independent bears (Barnes and

Smith 1997*a*). We estimated the population in all Unit 8 at 2040 independent bears and 2877 total bears (Barnes and Smith 1995). Average density on Kodiak Island was 185 independent bears/1,000 km^2 and average density for Afognak Island, the second largest island in Unit 8, was estimated at 102 independent bears/1,000 km^2. Because we have not done aerial surveys on Afognak Island, where dense Sitka spruce (Picea sitchensis) forest makes it difficult to observe bears, the population estimates for Afognak are tentative.

FWS aerial surveys along salmon streams in southwestern Kodiak Island indicated little change in composition of the brown bear population (Table 1). Single bears composed 46% and 39% of bears classified in 1994 and 1995, respectively.

Distribution and Movements

An FWS–ADF&G cooperative study on ecology of brown bears of the Aliulik Peninsula, begun in 1992, continued through 1996 (Barnes and Smith 1997*b*). Analysis of movements of 43 radiocollared bears indicated that bears used ocean beach habitat heavily in spring and fall and concentrated along salmon streams in summer. Little movement of bears occurred outside the Aliulik Peninsula, which is nearly surrounded by water. Bears denned in lowland habitat more commonly than occurred elsewhere on Kodiak Island and were somewhat active during winter. Adult females predicted to produce cubs did so in only 22% of the occasions, and females that denned in low elevation benchland habitat of the southern Aliulik Peninsula produced cubs in only 12% of the occasions. Mortality of males occurred principally by sport hunting, and females most often died of natural causes.

MORTALITY

Harvest

Harvest data for regulatory years 1985–95 are presented in Tables 2–8. Documented human-caused annual mortality averaged 178 bears during that period, ranging from 155 in 1989 to 208 in 1985 (Table 2). Total mortality in 1994 and 1995 was 179 and 156 bears, respectively.

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 to 30 November and 1 April to 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, may take bear by drawing permit only; nonresidents guided by a registered, master, or Class A assistant guide may take a bear by registration permit only.

Board of Game Actions and Emergency Orders. The Board of Game passed a regulation effective spring 1995 season requiring that nonresident hunters in 9 permit hunt areas in southern Kodiak Island must harvest either male bears, or females with skulls at least 15" long or 9" wide. That regulation was adopted instead of a reduction in hunting permits that had been recommended by the department to halt an increasing harvest trend. The new regulation further stipulated that for each bear that fails to meet the minimum skull size criteria, 1 permit will be removed from the nonresident allocation for that hunting area the following year.

Hunter Harvest. Hunters harvested 155 and 152 bears in regulatory years 1994 and 1995, respectively, slightly below the previous 5-year mean of 159.2 bears (Table 2). The 57 bears killed in fall 1994 exceeded the previous 5-year mean of 51.0 bears, but the 49 bears killed in fall 1995 was below average. The 98 bears killed in spring 1994 and the 103 bears killed in spring 1995 were less than the previous 5-year mean of 108.2 bears.

Males predominated in the harvest, composing 69.0% of the sport harvest in 1994 and 63.2% in 1995, compared to the previous 5-year average of 66.0%. 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 48 females in 1994 and 56 females in 1995, closely comparable to the annual mean of 58.0 females for the preceding 5 years combined. Including other human-caused deaths of females, 54 females were killed in 1994 and 58 females were killed in 1995, compared to the previous 5-year mean of 58.0 females.

Mean skull sizes and ages for both sexes showed little change in 1994 and 1995 (Table 8).

The minimum skull size requirement for permit hunts #208–216 was marginally effective in reducing harvest in that area. The new regulation, which became effective during the spring 1995 season, resulted in a slight decline in total harvest, from a mean of 53.3 bears for 1988–1993 to 49 bears in 1994 and 53 bears in 1995. As was predicted, harvest by nonresidents did decline from a mean of 30.2 bears for 1988–1993 to 26 bears in 1994 and 22 bears in 1995. However, residents harvested 31 bears in 1995, well above the previous 6-year mean of 23.2 bears. The minimum regulation was effective in reducing harvest of female bears by nonresidents. Only 2 females were killed by nonresidents in 1995, the first full regulatory year under the regulation, well below the mean of 7.8 females/year for 1988–1993. Average nonresident hunter success declined from 68% to 48%.

Permit Hunts. The number of permits issued for drawing hunts in 1994 and 1995 was stable (Table 3). Residents had 319 permits available each year, 107 in fall and 212 in spring. In 1994 59% of the residents hunted and in 1995 61% hunted. Nonresidents used 88% and 86% of the 153 available permits in 1994 and 1995, respectively. In the northeastern Kodiak Island hunt, where permits were not limited, 144 permits were issued in 1994, and 156 permits were issued in 1995 (Table 4).

Hunter Residency and Success. Mean annual hunter success in the drawing permit hunts was 54% and 46% in 1994 and 1995, respectively (Table 3). Mean annual hunter success in the registration permit hunt was 6% and 9% in 1994 and 1995, respectively (Table 4). Nonresident hunters harvested 56% and 47% of bears taken in 1994 and 1995, respectively (Table 5).

Harvest Chronology. Most bears were killed in November in the fall hunt and in May during the spring hunt (Table 6).

Transport Methods. Most hunters travel to their hunting areas by aircraft, and some use inflatables or skiffs to travel within their hunting area. Aircraft was the most commonly reported transportation method (Table 7).

Other Mortality

Defense of life or property (DLP) kills, illegal kills, and other nonhunting human-caused mortality totaled 24 bears in 1994 and 4 bears in 1995 (Table 2). An unusually high incidence of nuisance bear problems in Larsen Bay village in 1994 resulted in a minimum loss of 7 bears in defense of life or property and illegal killings.

The incidence of illegal or unreported DLP kills is unknown, but bears that have been shot but not reported are occasionally found near the villages of Larsen Bay, Old Harbor, and Port Lions. Cases in which deer hunters, hikers, sport and commercial fishermen, 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 only seasonally occupied by humans. 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 National Wildlife Refuge. 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. Those corporations are beginning to develop cabins and lodges close to brown bear concentrations on salmon streams, as well as selling some small parcels of land in important coastal brown bear habitat. The US Fish and Wildlife Service 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 US Fish and Wildlife Service.

Current developments with impacts on brown bears include ongoing commercial timber harvest on Afognak Island, proposed expansion of the Terror Lake hydroelectric project, growing rural settlement, commercial fishing, and increasing recreational activities in remote areas, including hunting, sportfishing, 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 National Wildlife Refuge has addressed many of those 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 the city of Kodiak are exacerbated by inadequate garbage disposal. Improperly maintained landfills continue to attract bears to villages, resulting in several DLP bear kills annually.

Developing environmentally sound and economical garbage disposals will require a multi-agency approach and will require 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 used. The high nonsport kill of bears near Larsen Bay in 1994 was attributed to the continued attraction of bears to an unmanaged landfill. Recent reductions in staff and budgets of the Department of Environmental Conservation have reduced that agency's efforts to enforce waste disposal regulations.

Greater commitment to providing public educational programs about bear/human conflicts, bear ecology, and management is a desirable long-term goal. We need to teach deer hunters better methods for avoiding brown bear confrontations while hunting and camping to help limit unnecessary bear kills every year.

Brown bear viewing and photography is a rapidly developing component of the summer tourism industry in Kodiak. 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. A trial bear viewing program, modeled after the well-known 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 FWS canceled the O'Malley program after 1994 because of a legal challenge to the procedures used in awarding the bear viewing concession to Munsey's Bear Camp. A private operator began a guided bear viewing program on Koniag Corporation land at Thumb River on Karluk Lake in 1995. 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

Fewer bears were harvested in 1994 and 1995 than in the previous 2 years, halting a recent increasing trend in harvest. Annual human-caused mortality of female bears was stable. Males composed>60% of the kill in 1994 and 1995, which met management objectives. The minimum skull size requirement in permit hunt nr. 208–216 resulted in only a slight decline in total harvest, but harvest of females by nonresidents in that area declined. The decline in nonresident hunter success indicates that guides have become highly selective because of the risk of losing a permit if a bear fails to meet minimum requirements. Only 1 nonresident hunter killed a bear that did not meet the minimum skull size since the regulation became effective in spring 1995.

We participated in intensive aerial surveys in the 3 new areas. The surveys indicated that bear density was lower than previously thought in the Spiridon Peninsula of western Kodiak Island and that bear density was higher than expected in the Ugak Bay and Kiliuda Bay drainages of eastern Kodiak Island. The FWS plans to continue doing an IAS annually on the KNWR, and I recommend that the department continue to participate.

Estimating the exploitation rate of brown bears requires both an accurate population estimate and accurate mortality data. Human-caused mortality is well documented for Unit 8, and population estimates developed from capture-mark-resight studies and aerial surveys are as accurate as possible with available techniques. Incorporating information from recent intensive aerial

surveys, we estimated the Unit 8 population at 2040 independent bears and 2877 bears. The 179 human-caused mortalities in 1994 equaled 6.2% of the estimated population, and 156 mortalities in 1995 represented 5.4% of the estimated population. This closely approximates the maximum exploitation rate of 5.7% for brown bears in Southcentral Alaska as estimated by Miller (1990*b*) based on simulation studies. Documented human-caused mortality in Unit 8 exceeded 6% of this exploitation rate in 7 of the past 11 years with no indication of a decline in either harvest data or survey data. Although I do not view this as a cause for alarm, it does indicate a continued need to monitor population and not allowing harvests to increase.

I recommend revising the Unit 8 management objectives to indicate the intent to provide both hunters and nonconsumptive users with optimum opportunities to see male and female bears of all ages. The implication of the recommended change is that the harvest would be held low enough to allow some bears of both sexes to die of old age. This objective would assure that hunters continue to be able to harvest large trophy bears. It corresponds well with FWS objectives to maintain population diversity in the brown bear population of the Kodiak National Wildlife Refuge. I also recommend an objective recognizing the acknowledged importance of limiting the harvest of adult females.

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Table 1 Unit 8 aerial stream counts of brown bears[a] 1985–1995

Regulatory Year	No. Complete surveys	Single Bears		Maternal bears		Yearling+cubs		New cubs		Total
		Nr.	%	Nr.	%	Nr.	%	Nr.	%	
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	4	230	46	86	17	136	27	49	10	501
1995	3	122	39	62	20	86	27	45	14	315

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

Table 2 Unit 8 brown bear harvest[1], 1985–95

Regulatory year	Reported: Hunter kill M	F	(%)	Unk	Tot	Nonhunting kill[2] M	F	Unk	Tot	Illegal kill[3] M	F	Unk	Tot	Total kill M	(%)	F	(%)	Unk	Total
1985																			
Fall 85	52	31	37	0	83	4	8	0	12	0	1	2	3	56	57	40	41	2	98
Spring 86	70	34	33	0	104	1	1	1	3	2	1	0	3	73	66	36	33	1	110
Total	122	65	35	0	187	5	9	1	15	2	2	2	6	129	62	76	37	3	208
1986																			
Fall 86	25	37	60	0	62	6	6	0	12	0	3	0	3	31	40	46	60	0	77
Spring 87	71	30	30	0	101	1	2	1	4	0	0	0	0	72	69	32	30	1	105
Total	96	67	41	0	163	7	8	1	16	0	3	0	3	103	57	78	45	1	182
1987																			
Fall 87	25	25	50	0	50	5	2	1	8	0	0	0	0	30	52	27	47	1	58
Spring 88	80	40	33	1	121	0	0	0	0	0	0	1	1	80	66	40	33	2	122
Total	105	65	38	1	171	5	2	1	8	0	0	1	1	110	62	67	38	3	180
1988																			
Fall 88	30	23	43	1	54	1	7	1	9	0	0	0	0	31	51	30	49	2	63
Spring 89	73	39	35	0	112	0	1	0	1	0	0	0	0	73	65	40	35	0	113
Total	103	62	38	1	166	1	8	1	10	0	0	0	0	104	60	70	40	2	176
1989																			
Fall 89	25	20	44	0	45	2	6	1	9	1	0	0	1	28	58	20	42	1	49
Spring 90	74	32	30	0	106	0	0	0	0	1	0	0	0	74	70	32	30	0	106
Total	99	52	34	0	151	2	6	1	9	0	0	0	1	102	66	52	34	1	155
1990																			
Fall 90	30	21	41	0	51	5	5	0	10	1	1	0	2	36	57	27	43	0	63
Spring 91	69	29	30	0	98	0	0	0	0	0	0	0	0	69	70	29	30	0	98
Total	99	50	34	0	149	5	5	0	10	1	1	0	2	105	65	56	35	0	161
1991																			
Fall 91	25	16	39	1	42	3	4	0	7	0	0	0	0	28	58	20	42	1	49
Spring 92	72	40	36	2	114	3	0	0	3	0	1	0	1	75	65	41	35	2	118
Total	97	56	37	3	156	6	4	0	10	0	1	0	1	103	63	61	37	3	167

Table 2 Continued

Regulatory year	Reported													Total kill					
	Hunter kill					Nonhunting kill[2]				Illegal kill[3]									
	M	F	(%)	Unk	Tot	M	F	Unk	Tot	M	F	Unk	Tot	M	(%)	F	(%)	Unk	Total
1992																			
Fall 92	39	23	37	1	63	5	5	4	14	0	0	0	0	44	61	28	39	5	77
Spring 93	74	39	35	1	114	0	2	0	2	0	0	0	0	75	65	41	35	1	117
Total	113	62	35	2	177	5	7	4	16	0	0	0	0	119	63	69	37	6	194
1993																			
Fall 93	35	19	35	0	54	1	3	2	6	0	0	0	0	36	62	22	38	2	60
Spring 94	78	30	28	1	109	2	1	6	9	0	0	0	0	78	72	30	28	7	115
Total	113	49	31	1	163	5	3	4	12	0	0	0	0	114	69	52	31	9	175
1994																			
Fall 94	42	15	26	0	57	14	5	0	19	3	1	0	4	59	74	21	26	0	80
Spring 95	65	33	34	0	98	0	0	0	0	1	0	0	1	66	67	33	33	0	99
Total	107	48	31	0	155	14	5	0	19	4	1	0	5	125	70	54	30	0	179
1995																			
Fall 95	29	20	41	0	49	1	1	0	2	0	1	0	1	30	58	22	42	0	52
Spring 96	67	36	35	0	103	1	0	0	1	0	0	0	0	68	65	36	35	0	104
Total	96	56	36	0	152	2	1	0	3	0	1	0	1	98	63	58	37	0	156

[1]Permits required for all hunters.

[2]Includes defense of life or property, research, and other verified human-caused accidental mortality; may include bears which were not sealed, but reported killed by reliable sources.

[3]Includes sub-legal age bears, sow with cubs, out-of-season kills and bears found shot.

Table 3 Unit brown bear harvest data for permit hunts numbers 201–259, 1985–1995

	Regulatory year	Permits Issued	Permits returned	Percent did not hunt	Percent successful hunters	Males	%	Females	%	Unk	Total[c] harvest
Hunt	1985	84	83	2	67	34	63	20	37	0	54
Fall	1986	87	85	1	55	21	48	23	52	0	44
(201-229)	1987[a]	126	126	3	39	23	48	25	52	0	48
	1988[b]	139	139	6	38	28	57	21	43	1	50
	1989	127	127	5	35	22	52	20	48	0	42
	1990	124	123	2	43	30	59	21	41	0	51
	1991	119	119	8	33	21	58	15	42	1	37
	1992	128	127	4	46	35	63	21	37	0	56
	1993	118	118	3	47	34	64	20	36	0	54
	1994	118	116	2	48	39	82	15	28	0	54
	1995	113	113	2	40	29	65	16	35	0	45
Hunt	1985	156	151	1	57	53	65	29	35	0	82
Spring	1986[a]	164	164	2	53	62	73	23	27	0	85
(231-259)	1987[b]	222	221	2	55	77	66	39	34	1	117
	1988	216	216	1	66	73	65	39	35	0	112
	1989	234	232	6	46	70	69	32	31	0	102
	1990	221	221	1	44	68	71	28	29	0	96
	1991	227	225	6	50	69	66	35	34	2	106
	1992	214	212	2	51	73	68	34	32	0	107
	1993	219	218	4	50	77	74	27	26	1	105
	1994	215	213	2	45	63	66	32	34	0	95
	1995	225	223	3	45	63	64	35	36	0	98

Table 3 Continued

	Regulatory year	Permits Issued	Permits returned	Percent did not hunt	Percent successful hunters	Males	%	Females	%	Unk	Total[c] harvest
Combined	1985	240	234	1	60	87	64	49	36	0	136
Fall &	1986	251	249	2	53	83	64	46	36	0	129
Spring	1987[a]	348	347	3	49	100	61	64	39	1	165
(201-259)	1988[b]	355	355	3	47	101	63	60	37	1	162
	1989	361	359	5	42	92	64	52	36	0	144
	1990	345	344	1	43	98	67	49	33	0	147
	1991	346	344	6	43	90	64	50	36	3	143
	1992	342	339	3	49	108	66	55	34	0	163
	1993	337	336	4	49	111	70	47	30	1	159
	1994	333	329	2	54	102	69	47	31	0	149
	1995	338	336	3	46	92	64	51	36	0	143

[a] Afognak Island group and additional areas of northeastern Kodiak Island (Hunt areas 227-229, 257-259) first included.

[b] Changed to single drawing for residents for fall and spring hunts; 2 drawings in previous years.

[c] Harvest figures may differ slightly from those in Table A because of differences in classification of illegal kills and unresolved discrepancies in hunter reports.

Table 4 Unit 8 brown bear harvest data for permit[a] hunt numbers R230 and R260, 1985–1995

	Regulatory year	Permits Issued	Permits returned	Hunters afield	Percent did not hunt	Percent successful hunters	Males	%	Females	%	Unk	Total harvest
Hunt	1985	535	495		29	8	17	61	11	39	0	28
Fall	1986	425	387		39	8	3	16	16	84	0	19
R230	1987	106	102		53	2	2	100	0	-	0	2
	1988	85	78		46	8	2	50	2	50	0	4
	1989	88	80		43	6	3	100	0	-	0	3
	1990	54	51		30	0	0	-	0	-	0	0
	1991	110	108		40	6	4[c]	80	1	20	0	5[c]
	1992	103	102	71	30	10	4	67	2	33	1	7
	1993	86	86	48	44	2	1	100	0	0	0	1
	1994	69	65	52	20	4	3	100	0	0	0	3
	1995	71	68	37	48	11	0	0	4	100	0	4
Hunt	1985	154	141		25	17	16	84	3	16	0	19
Spring	1986	140	136		23	16	9	56	7	44	0	16
R260	1987	51	51		57	14	2	67	1	33	0	3
	1988	50	41		22	0	0	-	0	-	0	0
	1989	55	51		41	13	4	100	0	-	0	4
	1990	63	60		37	5	1	50	1	50	0	2
	1991	73	71		15	13	3	38	5	62	0	8
	1992	98	92	66	28	9	1	20	4	80	1	6
	1993	70	68	45	34	9	1	25	3	75	0	4
	1994	75	68	45	40	7	2	67	1	33	0	3
	1995	85	83	58	32	9	4	75	1	25	0	5

Table 4 Continued

	Regulatory year	Permits Issued	Permits returned	Hunters afield	Percent did not hunt	Percent successful hunters	Males	%	Females	%	Unk	Total harvest
Combined	1985	689	636		28	10	33	67	14	33	0	47
Fall &	1986	565	523		35	10	12	34	23	66	0	35
Spring	1987	157	153		54	6	4	80	1	20	0	5
R230 & R260	1988	135	119		38	4	2	50	2	50	0	4
	1989	143	131		42	8	7	100	0	-	0	7
	1990	117	111		34	3	1	50	1	50	0	2
	1991	183	179		30	9	7[c]	54	6	46	0	13[c]
	1992	203	194	137	29	9	5	45	6	55	2	13
	1993	156	154	93	30	5	2	40	3	60	0	5
	1994	144	133	97	27	6	5	83	1	17	0	6
	1995	156	151	95	39	9	4	44	5	56	0	9

[a] No limit on number of permits issued.

[b] Afognak Island group and part of northeastern Kodiak Island changed to limited permit hunts #227-229 and #257-259.

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

Table 5 Unit 8 brown bear successful hunter[a] residency, 1985–95

Regulatory year	Local[b] resident	(%)	Nonlocal resident	(%)	Nonresident[c]	(%)	Total Successful hunters
1985	95	51	------		90	49	185
1986	66	40	------		100	60	166
1987	78	46	------		92	54	170
1988	71	43	------		94	57	165
1989	11	7	49	33	90	60	150
1990	7	5	47	32	95	63	149
1991	14	9	53	34	88	57	155
1992	16	9	58	33	103	58	177
1993	6	4	66	40	91	56	163
1994	10	6	58	37	87	56	155
1995	20	13	61	40	71	47	152

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

[b] All Alaskan residents included until 1989-90.

[c] Includes the following successful non-residents guided by next-of-kin: 1986/87 --3, 1987/88 --3, 1988/89 --4, 1989/90 --1, 1990/91 --2, 1991/92 --0, 1992/93 --1, 1993/94--1, 1994-95--1, 1995-96--3 .

Table 6 Unit 8 brown bear harvest chronology by season and month, 1985–1995

Regulatory Year	Fall					Spring					Regulatory Year Total[a]
	October		November		total	April		May		Total	
	Nr.	%	Nr.	%	Nr.	Nr.	%	Nr.	%	Nr.	
1985	31	37	52	63	83	49	47	55	53	104	187
1986	24	38	39	62	63	39	39	61	61	100	163
1987	28	57	21	43	49	41	34	80	66	121	170
1988	17	31	37	69	54	40	36	72	64	112	166
1989	21	47	24	53	45	36	34	70	66	106	151
1990	22	43	29	57	51	46	47	52	53	98	149
1991	20	49	21	51	41	50	44	64	56	114	155
1992	31	49	32	63	63	52	46	62	54	114	177
1993	27	50	27	50	54	52	48	57	52	109	163
1994	27	47	30	53	57	42	43	56	57	98	155
1995	21	43	28	57	49	41	40	62	60	103	152

[a] May differ slightly from Table 1 because of different classification of illegal sport harvest.

Table 7 Unit 8 brown bear harvest[a] percent by transport method, 1985–95

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3- or 4-wheeler	Snow-machine	ORV	Highway vehicle	Unknown	*n*
1985	82	0	13	0	0	1	3	1	187
1986	81	0	18	0	0	0	1	0	163
1987	85	0	12	0	0	1	0	2	170
1988	74	0	24	0	0	0	0	2	166
1989	73	1	21	1	0	0	1	4	151
1990	72	0	25	0	0	1	1	1	149
1991	51	0	41	0	0	1	7	0	156
1992	69	1	22	3	0	0	5	0	177
1993	72	0	40	2	0	0	1	0	163
1994	57	0	38	1	0	0	3	0	155
1995	70	1	23	3	0	1	2	0	152

[a] Permits required for all hunters; however, sport kills by hunters without permits are included here.

Table 8 Unit 8 sport-killed brown bear skull size and age by sex, 1980 through 1995

Year	Males				Females			
	Mean Skull size	*n*	Mean Age	*n*	Mean Skull size	*n*	Mean Age	*n*
1980	24.0	93	6.2	101	21.6	45	6.9	48
1981	24.2	78	6.5	79	21.7	39	7.1	39
1982	24.4	89	7.2	98	22.1	55	8.6	59
1983	24.6	128	7.4	130	21.6	60	7.9	62
1984	24.7	99	7.3	102	22.0	45	7.8	51
1985	24.5	116	7.4	120	21.9	57	7.2	64
1986	24.8	93	7.6	96	21.9	60	8.5	64
1987	24.6	100	6.7	104	21.8	63	6.6	65
1988	25.5	98	9.1	103	21.6	53	7.4	61
1989	25.4	96	9.0	97	21.6	48	8.7	52
1990	25.3	97	8.6	95	21.7	43	8.0	50
1991	25.0	91	8.4	96	21.7	52	8.0	56
1992	25.1	106	8.2	112	21.9	56	7.8	61
1993	24.4	109	6.8	113	21.8	45	7.2	48
1994	25.0	103	7.8	107	21.8	46	6.8	48
1995	25.2	94	7.5	95	21.8	50	7.4	55

LOCATION

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

GEOGRAPHIC DESCRIPTION: Alaska Peninsula

BACKGROUND

The Alaska Peninsula is a premiere producer of large brown bears, and the Board of Game (BOG) 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. We captured and marked 344 bears during 1970–75 to acquire information on reproductive performance, movements, and harvest rates. More recently, we have further analyzed 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 is continuing 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. Because of this limitation, 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 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. Surveys have been conducted subsequently near Black Lake by ADF&G, in the Becharof, Ugashik and Izembek areas by FWS, and in Katmai National Park by NPS. The ADF&G entered into a cooperative agreement with the U.S. Fish and Wildlife Service (FWS) and the NPS to conduct a comprehensive study near Black Lake, and an EVOS study initiated in 1989 along the Katmai coast is continuing under NPS funding.

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 increased. From 1985 to 1990 the average annual count of independent bears at Black Lake was 102 (range = 86–109); and from 1991 to 1996 the average annual count was 121 (range = 101–144) (Sellers, unpubl. data.). These data indicate a relatively stable

population during the late 1980s, followed by an incremental increase during the first half of the 1990s.

Population Size

Brown bear densities vary within Unit 9; densities were lower in western Subunit 9B and the Bristol Bay coastal plain. Results from the 1989 CMR population estimate (including bears of all ages) at Black Lake showed a density of 191/1000 km^2 for a 1215 km^2 (469 mi^2) study area. Within the study area, density varied among count units from 53 to 449 bears (of all ages)/1000 km^2 (1 bear/mi^2 to 1 bear per 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, Miller et. al. 1997). 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, with an overall density of 93 bears/1,000 km^2 (24 bears (of all ages)/100 mi^2 (Sellers and Miller 1991). I estimated national parks within Unit 9 and McNeil River State Game Sanctuary contain an additional 2000–2500 brown bears.

Population Composition

Evidence from the ongoing Black Lake study and analysis of harvest data show a change in the population composition since the early 1970s that is probably 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 U = 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 U = 1,345, 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. Family groups of cubs and yearlings were protected by hunting regulations, 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 1982–96, a mean of 37% of 9250 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 1994).

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. In that portion of Subunit 9A from Contact Point south to the border of McNeil River State Game Sanctuary, there was a drawing permit hunt in 1995–96 with the same season dates.

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 1991 legislation was passed to enlarged the McNeil River State Game Sanctuary and create the McNeil River State Game Refuge when the newly constructed Paint River fish ladder became operational. The Legislature directed the Board of Game to determine whether the new refuge should be closed to brown bear hunting (the new sanctuary lands were closed to all hunting and trapping in the legislation). The board considered this controversial and emotional issue at its fall meeting in 1991. Based on past harvests and estimated bear densities, the department recommended that harvests in that portion of Subunit 9A from Contact Point south to the boundary of McNeil River State Game Sanctuary average not more than 3 brown bears per calendar year. The Board endorsed the recommended harvest guideline of 3 bears per season and adopted a registration hunt for the 1993–94 regulatory year. Because 5 brown bears were killed in this area in the fall 1991 season, the spring 1992 season within this area was closed by emergency order. The fall 1993 and spring 1994 seasons were closed by emergency order to allow planning efforts to proceed. In fall 1993 the board established a drawing permit hunt for this portion of Subunit 9A for the 1995–96 regulatory year. In fall 1995 the board closed the McNeil River State Game Refuge to brown bear hunting beginning with the 1996 regulatory year. 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 16 October 1995 and 16 May 1996.

Hunter Harvest. During the 1994–95 regulatory year, only the Naknek registration hunt was open; hunters took 12 bears (Tables 1 and 2). The reported harvest for the 1995–96 regulatory year was 510 bears, including 353 males (69%) and 157 females (Table 1). Additionally, 4 bears were killed in nonhunting circumstances. I estimate the actual nonsport mortality at more than 50 bears. The fall 1995 harvest was the lowest since 1985, but the spring 1996 kill was the highest ever. The combined 1995–96 harvest was near the mean of 501 bears killed during 1985–93. 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 1993–96, 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. Not only has the number of mature males in the harvest increased but the proportion of the harvest of mature males has also increased for these 3 time periods: 14.3% during 1975–82; 16.9% during 1983–88; and 23.4% during 1989–96. It should be noted these changes in harvest patterns occurred over a period when the hunting regulations were relatively stable.

Based on an estimate of 5679 bears in areas open to hunting (Sellers and Miller 1991), a mean calendar year reported harvest of 261 for 1994–96, and an estimated 50 unreported DLP and illegal kills, the total harvest rate is estimated to be 5.5%.

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 total 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 10 years, the mean annual harvest has been 86 females.

Permit Hunts. In 1995 more than 3700 people applied for 8 permits available in the controversial drawing permit hunts 341–351 in Subunit 9A from Contact Point south to the border of McNeil River State Game Sanctuary. Most applicants sought to "retire" permits rather than hunt. One subadult female bear was killed in October.

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 1994 regulatory year, 10 bears (6 males and 4 females) were killed during the fall, and 2 males were killed during the spring hunt (Table 2). During the 1995 regulatory year, 5 males and 1 female were killed during the fall and 3 males during the spring (Table 2). 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 stopped in 1984, resuming in the fall of 1989. During this period of no hunting, the bear population 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. During fall 1995 3 bears were taken before the emergency order became effective. A hunter without a permit took 1 of the 2 bears killed during the spring 1996 season. For both seasons combined, 12 hunters received permits (Table 3).

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 "C&T" findings for the villages of Chignik Lake, Perryville, and Ivanof Bay. This hunt overlaps a federal subsistence permit hunt, which complicates issuing permits and collecting results. In 1994 a total of 8 permits, including 2 federal permits, were issued. Reported harvest included 2 bears from Ivanof Bay and 1 bear each from Perryville and Chignik Lake residents. The Subsistence Division documented the take of 3 other bears from these villages by nonpermittees. Three permittees did not report. In 1995 2 state permits were issued to Chignik Lake residents, one of whom killed a bear. The Subsistence Division documented a harvest of 5 other bears in 1995.

Hunter Residency. During the 1995–96 general season, nonresidents took 75% of the harvest. This is higher than the long-term average of 69% since 1989 (Table 4). In the 1995–96 Cold Bay registration hunt, local residents accounted for 54% of the permits and 80% of the harvest; other Alaskans accounted for the remainder. During the 1994–95 and 1995–96 Naknek drainage registration hunt, local residents accounted for 50% of the permits and 48% of the harvest; other Alaskans accounted for 40% of the permits and 24% of the harvest; nonresidents accounted for 10% of the permits and 29% of the harvest.

Harvest Chronology. Before 1985 the fall season began on 7 October. When the opening date was moved ahead to 1 October, the pattern of harvest also shifted (Table 5), 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. Hunters took 76% of the spring 1996 harvest during the first week of the season because of unseasonably favorable weather.

Transportation Methods. During the 1995–96 season 77% of 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. Eight bears were officially reported as DLP kills in 1994–95 and again in 1995–96; however, not all these were recovered for sealing. In 1995 10 other bears were killed and reported under unofficial but reliable circumstances. Unsubstantiated reports from villages, remote lodges, canneries, and commercial fishermen indicated that many other unreported bears are killed or wounded, and I estimate the total unreported kill at 50–100 bears per year. Conflicts between bears and people were particularly high during the 1996 summer because of a poor berry crop and an exceptionally low salmon escapement in the Kvichak drainage.

Preliminary estimates of survival rates (calculated with exclusion of 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, unpubl. data).

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Bear–human conflicts continue to be the most serious and challenging problem in Unit 9, as in many other parts of the state. Given the pervasive nature of this problem, a concerted effort by the department and other wildlife agencies and the public are warranted to limit this persistent conflict.

CONCLUSIONS AND RECOMMENDATIONS

Monitoring the trends in brown bear density or composition is difficult. 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 brown bear population now appears stable. I estimate 5679 bears inhabit the area of Unit 9 that is open to hunting. During 1994–96 the calendar year kill from all sources 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. Unit 9B can sustain an increased harvest, but population estimates for this area are crude and harvests are increasing. Subunit 9B has a positive "C&T" determination, and a special subsistence season could be considered. Beyond this, no regulatory changes are recommended.

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Table 1 Unit 9 Brown Bear Harvest including permit hunts, 1991–1995

Regulatory year	Reported: Hunter kill M	F	Unk.	Total	Nonhunting kill[a] M	F	Unk.	Total reported kill M (%)	F (%)	Unk. (%)	Total
1991											
Fall 91	162	108	2	272							
Spring 92	197	68	3	268							
Total	359	176	5	540	6	10	0	365 (66)	186 (33)	5 (1)	556
1992											
Fall 92	7	1	0	8							
Spring 93	6	1	0	7							
Total	13	2	0	15	3	3	0	16 (76)	5 (24)	0	21
1993											
Fall 93	160	86	1	247							
Spring 94	174	57	1	232							
Total	334	143	2	479	4	2	0	338 (70)	145 (30)	2 (1)	485
1994											
Fall 94	6	4	0	10							
Spring 95	2	0	0	1							
Total	7	4	0	11	5	2	0	12 (67)	6 (33)	0	18
1995											
Fall 95	132	97	0	229							
Spring 96	221	60	0	281							
Total	353	157	0	510	3	1	0	356 (69)	158 (31)	0	514

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

Table 2 Unit 9C, Naknek Drainage, brown bear harvest data by permit hunt, 1991–1995

Hunt No. / Area	Year	Permits issued	Number did not hunt	Number unsuccessful hunters	Number successful hunters	Number did not report	Harvest Males	Harvest Females	Harvest Total
361 Fall Unit 9	1991	43	7	12	4	20	4	0	4
	1992	39	7	26	6	0	5	1	6
	1993	35	4	24	6	1	4	2	6
	1994	40	8	21	10	2	6	4	10
	1995	32	8	26	6	0	5	1	6
371 Spring Unit 9	1992	12	0	5	1	6	1	0	1
	1993	18	3	7	7	1	6	1	7
	1994	12	3	7	5	0	4	1	5
	1995	7	3	2	2	0	2	0	2
	1996	14	0	11	3	0	3	0	3

Table 3 Unit 9D Cold Bay brown bear harvest data by permit hunt held in alternate regulatory years, 1991–1995

Hunt No. / Area	Calendar Year	Permits issued	Number did not hunt	Number unsuccessful hunters	Number successful hunters	Number did not report	Harvest Male	Harvest Female	Harvest Total[a]
362 Fall Unit 9D	1991	8	0	6	2	0	2	0	2
	1993	10	0	7	3	0	2	1	3
	1995	8	0	4	3	0	3	0	3
372 Spring Unit 9D	1992	4	0	2	2	0	1	1	2
	1994	6	0	4	2	0	0	2	2
	1996	4	0	2	2	0	1	1[b]	2

[a] Harvest quota of 2 bears; hunt closed by emergency order after 2 bears are reported.
[b] Illegal kill.

Table 4 Unit 9 brown bear successful hunter residency,[a] 1989–1996

Regulatory year	Unit resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total successful hunters
1989-90	20	(4)	124	(23)	405	(74)	549
1990-91	1	(11)	3	(33)	5	(56)	9
1991-92	13	(2)	118	(22)	409	(76)	540
1992-93	6	(40)	4	(27)	5	(33)	15
1993-94	15	(3)	114	(24)	333	(70)	479
1994-95	3	(30)	3	(30)	4	(40)	10
1995-96	19	(4)	108	(21)	378	(75)	505

[a] Includes permit hunt harvest.

Table 5 Unit 9 harvest chronology percent by month, 1981–1995

Regulatory Year	1–6 Oct	7–13 Oct	14–21 Oct	10–17 May	18–25 May
1981-82	0[a]	64	36	66	34
1983-84	0[a]	72	28	58	42
1985-86	45	29	26	47	53
1987-88	47	35	17	60	40
1989-90	47	30	23	55	45
1991-92	10[b]	65	25	59	41
1993-94	12[b]	62	26	58	42
1995-96	13[b]	56	31	76	24

[a] The general season for all of Unit 9 opened on Oct. 7.
[b] The general seasons in Subunits 9C, 9D, and 9E opened on Oct. 7.

Table 6 Unit 9 brown bear harvest[a] by transport methods, 1991–1995

	Percent of harvest								
Regulatory year	Airplane	Horse	Boat	3- or 4-wheeler	Snow-machine	ORV	Highway vehicle	Unknown	*n*
1989-90	85	0	9	0	0	1	1	2	549
1990-91	0	0	33	0	0	22	33	11	9
1991-92	87	0	10	0	0	1	0	2	540
1992-93	0	0	33	47	0	0	0	13	15
1993-94	80	0	15	1	0	0	2	1	479
1994-95	0	0	73	0	0	0	27	0	11
1995-96	77	0	18	2	0	0	1	1	521

[a]Includes permit hunt harvest.

LOCATION

GAME MANAGEMENT UNIT: 10 (1,536 mi^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 stable and maintained by natural limiting factors.

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 over 200 bears inhabit 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. Since 1991, annual harvests from Unimak Island have averaged 6.5 bears (range = 4–9). Males have composed 70% of the harvest since 1991 (Table 1).

Hunter Residency and Success. In the past 5 years, 13% of successful hunters were nonresidents, compared to 75% for Unit 9.

Approximately 38% of permittees did not hunt on Unimak Island. Of those who hunted, 73% were successful.

Harvest Chronology. Seven hunters killed bears during the first week of October and 2 killed bears during early November since the Board of Game extended the fall season through the end of December.

Transport Methods. Since 1991 90% of successful hunters used aircraft to reach Unimak Island, and only 10% of successful hunters used boats.

CONCLUSIONS AND RECOMMENDATIONS

The brown bear population on Unimak Island appears stable, and the drawing permit hunt meets management objectives. I do not recommend any changes in the permit hunt at this time. I recommend continuing late summer aerial surveys flown by the Izembek National Wildlife Refuge staff, and the entire island should be stratified to facilitate refinement of the bear density estimate.

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Table 1 Unit 10 brown bear harvest data by permit hunt, 1991–95

Hunt Nr. / Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Harvest		
						Male	Female	Total
375 Fall	1991-92	8	13	43	57	1	3	4
Unit 10	1992-93	8	50	75	25	1	0	1
	1993-94	8	37	20	80	3	1	4
	1994-95	8	37	20	80	3	1	4
	1995-96	8	12	14	86	2	4	6
376 Spring	1991-92	7	86	100	0	0	0	0
Unit 10	1992-93	7	43	0	100	4	0	4
	1993-94[a]	8	12	33	67	3[b]	1	4
	1994-95	7	43	25	75	3	0	3
	1995-96	7	57	0	100	3	0	3
Totals for	1991-92	15	47	50	50	1	3	4
all permit	1992-93	15	47	38	62	5	0	5
hunts	1993-94	16	25	27	73	6	2	8
	1994-95	15	40	22	88	6	1	7
	1995-96	15	33	10	90	5	4	9

[a] One permittee did not report.
[b] Includes 1 DLP kill by a permittee.

LOCATION

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

GEOGRAPHIC DESCRIPTION: Wrangell Mountains

BACKGROUND

Brown bears were numerous in Unit 11 before 1948–1953, when federal poisoning programs directed at controlling wolves are thought to have 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 7 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 comprising 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, determined their sex, extracted a premolar tooth for aging, and gathered information on date and location of the harvest, days afield, and transportation mode from successful hunters.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population data were unavailable for brown bears in Unit 11 because neither surveys nor censuses have been conducted. Frequent observations of bears by department staff and the public indicate a relatively abundant and well distributed population of brown bears.

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 (COY), move into riparian areas to feed on sprouting plants and berries. They also scavenge carcasses of ungulates that died during winter. Females with COY 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, especially in the lower Chitina River Valley during late summer and fall. Most brown bears in Unit 11 probably den at elevations >3500 ft.

MORTALITY

Harvest

Seasons and Bag Limits. The open seasons for resident and nonresident hunters in Unit 11 was 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 designated "hard" park. The NPS position was that only subsistence hunting by local rural residents was allowed in the "hard" park. There has been no additional board action for Unit 11 brown bears since 1989.

Hunter Harvest. Six brown bears were reported killed during 1994–95 while only 2 bears were reported during 1995–96 (Table 1). Percent males in the harvest was below current management guidelines in 1994–95, but so few bears were taken that percent data are meaningless. The mean age for males was 6.0 years during 1994–95 and 5.3 years during 1995–96. The mean age for males over the past 10 years was 7.1 years.

Hunter Residency and Success. Nonresident hunters took 2 brown bear during the 1994–95 season and 0 bears in 1995–96 (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 1994–95 and 1995–96 seasons. Since 1979 hunter-effort data show a mean of 5.2 days spent to take a bear in Unit 11.

Harvest Chronology. Sixty-seven percent of the 1994–95 and 100% of the 1995–96 brown bear harvest occurred during 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 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 in 1995, the first nonhunting means reported since 1990. Historically, nonhunting kills were all taken in defense of life or

property (DLP). 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. Because of the work involved with salvaging and preserving the hides and skulls of DLP bears, more bears are probably killed each year than are reported. Compliance with reporting requirements on DLP bears would be higher if individuals were not required to salvage the hide and skull. Since 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 could increase DLP kills because the requirement to salvage the hide is a deterrent to killing bears.

HABITAT

Assessment

Because of the remoteness of this unit, there are few cabins or homesites. 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 clearly increased in recent years; as a result, bear problems will become more frequent and result in more DLP kills. Overall, Unit 11 is considered 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 areas designated as "park." However, aircraft use was not allowed to access park areas, 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 brown bears were not a customary and traditional animal for state subsistence in Unit 11. Sport hunting of brown bears and aircraft access 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. Recently sex composition, mean age, and skull sizes often fluctuate annually because of small sample size. Generally, bears taken in Unit 11 are older and larger than those taken in adjacent Unit 13, where harvest rates are higher.

Bear harvests were very low, and they occurred in limited areas. Current harvests do not affect the brown bear population in Unit 11. No changes in season length or bag limit are recommended at this time.

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Table 1 Unit 11 brown bear harvest, 1991–96

Regulatory year	Hunter kill M	F	(%)	Unk	Total	Nonhunting kill[a] M	F	Unk.	Estimated kill[b] Unreported illegal		Total estimated kill M	(%)	F	(%)	Unk.	Total
1991-92																
Fall 91	2	0		--	2	--	--	--	--	--	2	(100)	0	(0)	--	2
Spring 92	1	0		0	1	--	--	--	--	--	1	(100)	0	(0)	0	1
Total	3	0		0	3	0	0	0	1	1	3	(100)	0	(0)	2	5
1992-93																
Fall 92	3	1	(25)	--	4	--	--	--	--	--	3	(75)	1	(25)	--	4
Spring 93	2	0	(0)	--	2	--	--	--	--	-	2	(100)	0	(0)	--	2
Total	5	1	(17)	--	6	0	0	0	1	1	5	(83)	1	(17)	2	8
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

[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, 1989–96

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

[a] Local resident means resident of Unit 13.

Table 3 Unit 11 brown bear harvest chronology percent by month, 1989–96

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

Table 4 Unit 11 brown bear harvest percent by transport method, 1989–96

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

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 area (approximately 2500 mi^2) not commonly being used by bears is dominated by high mountains (>7000 ft), devoid of vegetation, or covered by large ice fields. Little is known about the population trend of grizzly bears in Unit 12, but based on historical harvest data, most of the unit probably supported natural densities of grizzly bears. In those portions of the unit that were mined extensively or had human settlements, the bear population has been regulated at low levels.

Since 1900, hunters, and periodically miners, actively sought grizzly bears in southeastern Unit 12. Bear hunting regulations became more restrictive at the time of statehood until the early 1980s when guiding activity increased in the unit. During the 1970s the unit's moose population declined substantially, and grizzly bears were an important predator on moose calves. 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); however, further analysis found no evidence that bear reduction contributed to the moose population increase (Miller and Ballard 1992). To reduce bear predation on the declining moose population in Unit 12, grizzly bear hunting regulations were liberalized in 1981.

During the mid-1980s, bear harvests increased by 29% 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. Management objectives called for elevated grizzly bear harvests until moose numbers approach stated objectives or there is indication that the harvest is 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 to the unit's grizzly bear population.

MANAGEMENT DIRECTION

MANAGEMENT GOAL

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

MANAGEMENT OBJECTIVES

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

- Seal bears; analyze harvest data

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 location of harvest and time spent afield by the hunter. Premolar teeth were sent to Matson's Laboratory (Milltown, Montana USA) to be aged.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

I estimated the current Unit 12 grizzly bear population to range from 290 to 426 bears (15.0 to 22.0 bears of all ages/1000 km^2) and population trend to be stable. My estimate was based on extrapolations from point estimate surveys conducted in similar type habitats. To monitor grizzly bear population trend, I used harvest statistics (total harvest, sex ratio, and average skull size, and age of the 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 1973 and 1982. During this period annual harvests averaged 20.1 bears/year (s = 4.7) and were primarily taken in 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 1984 and 1987, grizzly bear numbers in these areas continued to decline due to increased harvest ($\bar{x}$ = 26 bears/yr, s = 6.1), caused by more liberal harvest regulations. Since 1986, harvest declined to 15.6 bears/year (s = 5.5), but harvest distribution remained the same. Average skull sizes of harvested males were comparable between periods 1973–1983 (20.8 inches, s = 1.1) and 1987–1995 (20.6 inches, s = 0.55). Average skull size (19.6 inches, s = 0.49) was smaller between 1984 and 1987. The primary difference between the periods was that from 1984 to 1987 no grizzly bear tag fee was required.

The estimated kill density for these areas ranged from 4.1 bear/1000 mi^2 in the northern Wrangells and Mentasta mountains to 3.6 bears/1000 mi^2 in the Tok River drainages. In Unit 20A a kill density of 2.2/1000 mi^2 occurred during a period the bear population declined by 28% (Reynolds, unpubl data), and in Unit 20E the kill density averaged 3.34/1000 mi^2 during a period the bear population had declined by 38% (Gardner 1995). In the remainder of Unit 12, the kill density averaged 0.37 bears/1000 mi^2 and probably has not affected population trend. Based on total harvest and harvest location during the past 3 years, the

Unit 12 grizzly bear population is 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	Nonresident Open Season
Unit 12, 1 bear	1 Sep–31 May	1 Sep–31 May

A bear taken in Unit 12 does not count against the 1 bear/4 years bag limit in other units. However, no person may take more than 1 bear statewide per regulatory year.

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 could affect grizzly bear numbers in adjacent northwestern Unit 12.

Hunter Harvest. Based on the estimated population size, the sustainable harvest in Unit 12 is 24 bears; 8 females may be harvested. During the 1995–1996 regulatory year, hunters reported taking 8 bears (6 males, 2 females), which is below the 5-year average harvest of 15 bears (Table 1). This is the lowest harvest since 1973, despite comparable numbers of hunters in the field. The reason for the low harvest may be related to weather or berry crops. Blueberry and cranberries were abundant in almost all habitat types, allowing bears to travel less to find adequate food; this should decrease the possibility of encountering hunters or being attracted to moose and caribou carcasses. In 1996 the preliminary reported fall harvest was 13 bears (54% male).

In Unit 12 we have tried different season and bag limit requirements to increase the grizzly bear harvest. Increasing the bag limit to 1 bear/year in 1982 caused little change in harvest. During 1984 and 1985 the grizzly bear tag fee requirement was waived, and harvest increased to 30 and 29 bears, respectively. Only in 1973–1974 has the harvest in Unit 12 been that high (28 bears). In contrast, total harvest did not increase in adjacent Unit 20E when the tag fee requirement was waived. The greatest increase in harvest in Unit 12 was during spring 1984, indicating the increase in harvest was not incidental to moose and caribou hunts but due more to advertising of the area. The harvest increased significantly ($P = 0.001$) after a public awareness campaign and a change in the bag limit to 1 bear/year.

Hunter Residency and Success. In 1995–1996 resident hunters took only 12.5% ($n = 1$) of the harvest in Unit 12, compared to the 5-year average of 33% (Table 2). The reduced resident harvest during the past 2 years may be due to reduced bear numbers in the more accessible areas where residents commonly hunt moose. The number of grizzly bears taken by guided

hunters increased over the past 4 years as guides are booking more moose/sheep/bear combination hunts. Before the 1 bear/year regulation in 1982, nonresident hunters took 63% of the harvested grizzly bears in Unit 12, compared to 34% between 1982 and 1991 after the regulation was enacted. At least for that 10-year period, residents took advantage of the 1 bear/year bag limit. Between 1991 and 1992, the bag limit was changed back to 1 bear/4 years and resident harvest began to decline. Resident harvest has not responded to the more liberal regulations reenacted in 1992, indicating that either many residents are not aware that the bag limit has been liberalized to 1 bear/year or that, for some other reason, the incentives are not high enough to draw residents to the area.

Harvest Chronology. During 1995–1996, 75% of the harvested grizzly bears were taken during September; the 5-year average was 70% (Table 3). Historically, most of the harvest has been taken during September when most resident moose and caribou hunters and guided hunters are afield.

Transport Methods. Following historical patterns, most successful grizzly bear hunters in Unit 12 used horses during 1994 and 1995 (Table 4). During the past 9 years, hunters using 3- or 4-wheelers as their primary transportation have harvested only 7 bears. The increase in the use of horses during the past 4 years indicates increasing guide activity in Unit 12, as horses are used by most of the guides but only by a few residents.

Other Mortality

Intraspecific mortality inflicted by adult male bears is probably the greatest source of nonhunting bear mortality in Unit 12. Taking of grizzly bears in DLP incidents has been minimal.

HABITAT

Assessment

Unit 12 constitutes good grizzly bear habitat with the exception of about 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.

Enhancement

Maintenance of a near-natural fire regime through provisions of the *Alaska Interagency Fire Management Plan: Fortymile Area* constitutes the only action taken in the unit to restore overall habitat diversity and productivity for all species. Restoration of moose and caribou abundance would also benefit grizzly bears indirectly through increased availability of ungulate biomass.

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 allow for greater survival of moose calves.

Moose calf survival increased beginning in the mid-1980s in the areas of the greatest bear harvest. However, we found that calf survival also increased in areas that received little bear harvest in adjacent Unit 20E. After using this management technique for 14 years in Unit 20E and 12 years in Unit 12, we still do not understand the effects of hunter-induced grizzly bear population reductions on moose calf survival.

Reducing predator populations through conventional hunting and trapping is currently a socially accepted method of predator control. The public believes the method works and commonly asks the department for more bear reduction programs. In order to maintain our credibility with the public and the scientific community, we need to determine if and when this method works as a valid predator control 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 Interior Alaska. In Unit 12, based on the current estimated population size, about 24 bears including a maximum of 8 females can be harvested annually without causing the bear population to decline, assuming that harvest is evenly distributed in the unit. During the past 12 years, the annual female quota has been exceeded only 3 times and the overall quota only once. Based on Unit 12's harvest history, we can continue to offer liberal seasons and bag limits but need to develop techniques to ensure more evenly distributed 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 easy to use for the hunter and area management biologist.

CONCLUSIONS AND RECOMMENDATIONS

Grizzly bears continue to be well distributed throughout Unit 12. The 1996 population estimate was 290 to 426 bears (15.0 to 22.0 bears of all ages/1000 km^2) and the population trend seems stable. Liberal harvest regulations have allowed for maximum hunter opportunity, especially for Alaska residents and have probably caused a reduction in the number of bears in the northern Wrangell and Mentasta mountains, in the Tok River drainages, and near the permanent Unit 12 communities.

Since 1982 the primary objective for liberalizing grizzly bear harvest regulations in Unit 12 has been to cause a temporary reduction of the unit's grizzly bear population to allow for greater moose calf survival. During the period of liberal regulations, the bear harvest increased and caused reductions in bear numbers in some areas, but the effects of this program on moose calf survival are not yet known.

Before justifying new regulations for increasing grizzly bear harvest to increase moose calf survival, the effects of this type of management program in both high and low density moose areas should be analyzed carefully. However, we do not need to restrict seasons and bag limits in Unit 12 but should add additional safeguards by placing a limit on annual harvest and on the number of females. This should ensure adequate protection for the bear population. I recommend we present a harvest management plan for grizzlies to the Board of Game during spring 1998 that includes these factors.

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Table 1 Unit 12 grizzly bear harvest, 1989–1996

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[b]															
Fall 1996	7	6	0	13	0	0	0	0	0	7	(54)	6	(46)	0	13

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

[b] Preliminary harvest.

Table 2 Unit 12 residency of successful grizzly bear hunters, 1989–1996

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[a]	1	(8)	3	(23)	9	(69)	13

[a] Preliminary harvest.

Table 3 Unit 12 grizzly bear harvest chronology by time period, 1989–1996

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[c]	13	(100)	0	(0)	0	(0)							13

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

Table 4 Unit 12 grizzly bear harvest by transport method, 1989–1996

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[b]	2	(15)	7	(54)	0	(0)	3	(23)	0	(0)	1	(7)	0	(0)	0	(0)	0	(0)	13

[a] Includes 1 DLP bear.
[b] 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 1991 brown bear harvests declined from levels reported during the mid 1980s.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

To maintain a minimum unit population of 350 brown bears

METHODS

Department representatives sealed skulls and hides of harvested bears. Sealers measured skulls, determined sex, and extracted a premolar tooth from each harvested bear for aging. Department staff also collected information on date and location of harvest and number of days that successful hunters were afield.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Brown bear density estimates are available for 2 different study areas in Unit 13E. Because both study areas were studied twice, comparison of the results between years, as well as between study areas, provides information on the population status and trends of brown bears in Unit 13E. The first brown bear estimate was made in 1979 on the Upper Susitna Study Area. This estimate of 10.5 independent bears/1,000 km^2 was the result of a bear translocation project that W. Ballard and others investigated brown bear predation on moose calves (Ballard et al. 1982; Miller 1988, 1995). The second density estimate in this area, completed in 1987, was 6.36 independent bears/1,000 km^2 (Miller 1988, 1995). Because of differences in the methods used between years to determine densities, it could not be statistically demonstrated that bear numbers declined, even though the 1987 estimate is much lower (Miller 1995). The second study area was initially surveyed as part of the initial investigations on impacts of a proposed Susitna River Dam Project. Density estimates for the Su-Hydro Study Area in 1985 and 1995 are 18.75 and 23.31 independent bears/1,000 km^2, respectively (Miller 1995). These results indicate at least stable or possibly increasing brown bear numbers in this more remote portion of Unit 13E.

Another density estimate will be completed in 1998 in Subunit 13A West. The first year's fieldwork was completed in 1996 as part of research associated with intensive management activities in 13A West. Bear densities in this area may be similar to those in the Su-Hydro Study Area during 1995 (Miller, pers. commun.).

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 on field observations, hunter reports, and harvests. Extrapolations from density estimates from 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 ≥2.0 years of age (Miller 1990*b*). Based on a model of sustainable harvest rates, 640 to 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 pers. commun.). Population estimates for large areas like Unit 13 are not statistically defensible, and consequently should not be used as the basis for population objectives or management (Miller pers. commun.).

Population Composition

Miller (1993) reported that during 1980 to 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). Based on these reproductive parameters, the brown bear population in Unit 13 has a typical reproductive potential for an interior population, similar to that north of the Alaska Range (Reynolds 1993).

Miller (1995) presented the sex ratios of brown bears in the Su-Hydro Study Area during 2 different censuses. 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 (a 10-year period) in the mean age of brown bears in the study area.

MORTALITY

Harvest

Season and Bag Limit. Between 1990 and 1993 the hunting season in Unit 13 for resident and nonresident hunters was 10 September–31 May, except Subunit 13D where the season was 1 September–31 May. The 1993–94 and 1994–95 hunting seasons were 1 September–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. In 1995 the season changed to 10 August–31 March in all 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 unitwide.

Board of Game Actions and Emergency Orders. During its January 1995 meeting, the Board of Game eliminated the 25-dollar resident tag fee requirement for brown bears in Unit 13 effective 1 July 1995. The intent of the board was to increase Unit 13 brown bear harvest.

This was the same justification used by the board to lengthen the fall season by 10 days a year earlier. The effect of these liberalized seasons and bag limits is that they encourage the incidental or opportunistic taking of brown bears by moose and caribou hunters. 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 concerning brown bears 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 intending 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 unitwide, except in Subunit 13E west of the Alaska Railroad. The board liberalized the bag limit to 1 bear each year. The board also instructed ADF&G to develop intensive management plans for brown bears, and this planning effort will be presented to the BOG in 1997.

Hunter Harvest. The reported 1995–96 sport harvest of brown bears was 127. This take was 30 (31%) bears above the 1994–95 harvest of 97. The average annual take was 112 bears/year for the last 2 years since the board began liberalizing bear seasons. The average yearly harvest was 125 bears a year (range = 97–138) during the 5-year period, between 1982 to 87, when harvests were historically the highest because of the yearly 1-bear bag limit. The average annual harvest during the 5-year period from 1988 to 92, following a reduction in the bag limit and a 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 - 25, 13C - 9, 13D - 17, and 13E - 51. In all subunits except 13C and 13D, the reported harvests were well above harvests reported since brown bear regulations were restricted in 1988. Units 13C and 13D have had. more stable harvests through the years. In 13E the reported take of 51 bears was the second highest harvest ever reported, the highest being 52 bears in 1985–86, and exceeded the average annual harvest of 45 bears a year, reported during the 4 peak harvest years 1984–87.

The 1995–96 brown bear harvest was 54 (43%) males and 73 (57%) females (Table 1). Females predominated in the harvest in all subunits except 13A and 13D, where harvest rates were the same (50:50) for both sexes. Subunit 13E had the most skewed sex ratio in the harvest with only 18 males (35%) taken, compared to 33 females (65%). The mean skull size was 21.1 inches for males and 19.9 inches for females. The mean age was 5.4 years for males and 6.6 years for females. 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 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.

Most of the yearly harvest in Unit 13 comprises young males, indicating recruitment and/or immigration into the population. There are, however, old individuals taken every year,

indicating that heavy bear harvests in previous years have not completely cropped the bear population. The older males are more often taken during the spring because hunters can select for older bears by hunting in early April; older males are the first to emerge from dens. Young males are often incidental fall kills by hunters taking bears as they can while hunting other big game species. We speculate that older females are taken in the fall because they are reproductively active and may have had cubs during the spring. Harvesting females with cubs is illegal, which makes females less vulnerable in spring. However, if cubs become lost during summer, some females are again legal and vulnerable in the fall.

Hunter Residency and Success. Nonresident hunters took 34 (27%) bears in 1995–96 (Table 2). The average annual nonresident harvests between 1991 and 1996 was 32 bears, an increase of 14% over the 28 bear/year average take for nonresidents. Local residents took 4 (3%) bears. Harvest by locals fluctuates between years with no trend evident. The highest harvest by local residents was 19 bears in 1992–93. The nonlocal Alaska resident harvest increased in 1995–96 with the reported take of 87 (69%) bears. Nonlocal Alaskan resident bear harvests have not been this high since the mid-1980s when liberal seasons and bag limits were also in effect. During the mid-1980s (1983–87) nonlocal Alaskans averaged 90 bears/year. Of all successful resident hunters in 1995, only 13% reported having a resident bear tag. Between 1987 and 1995 the nonlocal resident harvest declined (51%) to an average of 44 bears/year. Successful hunters averaged 3.8 days in the field in 1995–96 and 4.4 in 1994–95. During the last 15 years in Unit 13, hunters spent an average of 4.2 days afield, indicating little change in hunting effort.

Harvest Chronology. For the 1995 regulatory year, hunters harvested 100 bears (79%) during fall and 27 in spring (Table 3). Fall season has been the most important in terms of overall bear harvests. From 1992 to 1994 the fall season accounted for 57 to 64% of the total harvest. The one exception was in 1991 when only 44% of the total harvest occurred fall season. Spring harvests have fluctuated between years (Table 1). The reason for this fluctuation is unknown but may be related to snow conditions. Because snowmachines are important transportation during spring, a drop in the April harvest (Table 3) indicates poor spring snow conditions or severe weather that may have led to hunter access problems, reducing bear harvest during the 1994 and 1996 spring seasons.

Males composed only 40% (n = 40) of the fall take in 1995. This is the lowest percent males observed in the fall harvest since 1987 when males made up only 35% of the fall kill figure. The percent males in the fall harvest was also low during the entire period from 1983 to 87 when bear harvests were high because of the 1 bear/year bag limit. Males have averaged 57% of the fall take for the last 20 years. Historically, the percent females has exceeded 50% in the fall harvest during the first 10 days of September. Increasing the season length from 1 September to 10 August provided for an additional increase in the harvest of females. Chronology data by week for the fall 1995 season shows 44% of the fall take came during the 10–30 August extension. Chronology data by week for Alaskan residents show that peak brown bear harvests coincided with the caribou season opener on 10 August and extended through moose season. Nonresident hunters primarily took bears during September while hunting moose.

The percent males in the spring 1996 harvest was 52% (n = 14). This represents the lowest male composition figure ever reported during a spring season. Since 1980 when spring seasons started, males have averaged 69% of the take. 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 1996 the April harvest was the lowest ever reported for this month (Table 3). Since April harvests comprise mostly males, a substantial decline in harvests during this month will skew the sex ratio of the spring harvest from that observed when April harvests are near normal levels.

Transport Methods. Four-wheelers were the most important method of transportation for brown bear hunters in Unit 13, followed by aircraft and highway vehicles in 1995–96 (Table 4). The importance of 4-wheelers as a transportation method has risen during the last 4 years; during the early fall seasons, 4-wheelers are especially popular with caribou and moose hunters. Unit 13 provides many areas with extensive trail systems ideally suited to 4-wheeler transportation during fall season. Extending the fall bear season provided the opportunity for increased incidental bear harvests while hunters primarily targeted moose and caribou. Since the most important transportation method for both these species are 4-wheelers, it is little wonder 4-wheelers have passed aircraft in importance for bear hunters. 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 the unit due to increased ORV penetration into previously untraveled parts of the unit. In approximately 1989 snowmachines increased in importance when their design changes provided more power and reliability, allowing hunters more access to areas formerly considered too rough or remote. Transportation data showing increased use of snowmachines coincide with chronology data of increased bear harvests during the month of April.

Other Mortality

There were 18 brown bears reported killed in defense of life or property (DLP) during this reporting period. This averaged out to 3.6 bears a year, compared to the 2.8 bears per year average since 1961. The reported DLP harvest has always been considered a minimum estimate because some bears are shot and not reported, especially at remote cabins, homesites 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 their DLP claim is not valid. The highest reported DLP kill during this reporting period occurred in 1992–93 when 6 were taken. Reported DLP incidents did decline throughout this report period; only 1 bear was reported in 1995. The reason for the decline in DLP kills may have been because the bear hunting regulations became less restrictive throughout the reporting period. Problem bears could then be taken more easily as a sport kill because seasons had been lengthened and a resident bear tag was not required.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Brown bear management addresses the persistent concerns of user group conflicts and bear/human conflicts, arising from divergent public attitudes concerning brown bears. One segment of the population likes to observe brown bears and favors management objectives

that provide for as many bears in the population as biologically possible. In contrast, some of the public, especially local residents, do not like living close to bears. These individuals have usually experienced property damage, livestock or pets killed by bears, or fear personal injury. Periodical publications and news articles about bear conflicts encourage and maintain the public's fear of bears. Frequent "scare" articles in the media perpetuate fear and are hard to overcome.

Consequently, this fear of bears creates a problem for management during a time that public use and recreation are growing in Unit 13. In dealing with bear/human conflicts at remote sites, I recommend the department maintains its policy of non-lethal controls or relocating chronic problem bears to suitable remote habitat. However, the policy is problematic near homesites and recreational areas such as Kenny Lake or Lake Louise where there are numerous dwellings. An action plan or policy is needed for semi-developed areas, especially along the road system, as these are sites of frequent bear/human conflicts.

CONCLUSIONS AND RECOMMENDATIONS

A major problem pertaining to brown bear management is the difficulty in collecting 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 the importance of population data for managing hunted populations of brown bears, research efforts in recent years have been focused on developing methods of obtaining population data. As a result of these research projects, we obtained density estimates on 2 adjacent study areas during 4 population estimation attempts over a 16-year period from 1979 to 1995. Both study areas were studied twice, providing trend data and comparisons between years.

On the Upper Susitna Study Area, confidence intervals obtained during 1979 and 1987 surveys indicated the estimates varied from exhibiting no change in bear numbers to a 50% decline. Brown bear harvests were high along the Denali Highway between these estimates; indicating a possible decline. Also, gold mining activity increased appreciably in the study area between the censuses; a miner confided that killing brown bears at claim sites and not reporting the kill as a DLP bear occurred with some frequency. This nonreported DLP mortality could have contributed to a decline and makes evaluating effects of sport harvest on bear numbers in the Upper Susitna Study Area much more difficult.

The Su-Hydro Study Area is a more remote portion of 13E. A comparison of density estimates between 1985 and 1995 indicates a stable or slightly increasing brown bear population. This finding is important because Subunit 13E receives heavy hunting pressure, and the brown bear harvests over the last 15 years were higher than any other subunit in Unit 13. Changes in the sex ratio reflect that high brown bear harvests in this area have reduced the number of males:100 females but not the size of the population or the mean age of captured bears.

Comparison of census data between areas indicates a much lower brown bear density in the very accessible Upper Susitna Study Area than in the adjacent, but more remote, Su-Hydro area. It appears that in a small area where hunting effort is high or is coupled with DLP

harvests due to human habitation, hunters may be able to reduce brown bear numbers. The impacts of hunting may also depend on the sex and age class of bears taken. Speculation continues on the effects on the brown bear population of illegal DLP's by miners. Because females with cubs are protected under sport hunting regulations, the sex of the DLP killed bears is important. If miners killed adult females with cubs, this could have greatly affected population trends. Increased DLP killing that may have included adult females points out the importance of limiting remote cabins and claims in important brown bear habitats.

Research results comparing changes on the Upper Susitna area between years, coupled with modeling, predicted a rather large drop in bear numbers throughout the unit. This prediction of a decline was clearly in conflict with other information. Bear sightings by staff conducting fieldwork, harvest data, and reports from the public did not support the conclusion of a large decline. Yearly caribou counts in 13A and moose calf surveys in the Upper Susitna Study Area always produced numerous bear sightings with, of course, yearly fluctuations. Also, based on sex and age data in the harvest, we continue to harvest larger, older males at a rate that does not indicate a population decline. Hunter effort or the time needed to take a bear did not increase, a fact inconsistent with a declining bear population. Public reports, especially from rural residents, also indicated no decline. Management staff had clearly received conflicting signals on whether the Unit 13 brown bear population had declined significantly, as some research results suggested. The results of the 1995 density estimate justify some degree of hesitancy in concluding a large decline in bears throughout Unit 13.

The Board of Game, in its discussion relating to intensive management, identified brown bear predation of moose calves in Unit 13 as an important source of nonhuman mortality based on ADF&G predator–prey research results. 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 was to reduce brown bear numbers in Unit 13 by increasing 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, in spite of increased harvests, brown bear numbers were not reduced throughout the unit. Even in the Upper Susitna Study Area, sport harvests and DLP kills did not reduce bear numbers as much as the brown bear translocation did. Whether future sport harvests can reduce bear numbers enough to appreciably reduce brown bear predation on moose calves is unknown.

High sport harvests of brown bears may not have the same impact on overall bear numbers as predicted using harvest models, because the Unit 13 brown bear population is not closed, but the extent and effects of immigration 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 immigrants. 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 habitat types.

Hunting regulations became more liberal during this reporting period when 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 ≥2.0 years (Miller 1988). This rate would result in an estimate of sustainable harvest of 85 bears a year. Current harvests that resulted after liberalizing seasons and bag limits for intensive management exceed this number. Also liberalization increases the vulnerability of females. Historic harvest data indicate that sow harvests are higher during the earlier portion of the fall season. The high female harvest in fall 1995 was the direct result of the season extension into August. 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. Harvest modeling predicts the brown bear population cannot sustain such increased harvest pressure very long. It is very important that the effects of increasing sport harvests be adequately documented. Research should be focused on fully evaluating the impact 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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Table 1 Unit 13 brown bear harvest, 1991–96

Regulatory year	Hunter kill						Nonhunting kill[a]			Total estimated kill					
	M	(%)	F	(%)	Unk	Total	M	F	Unk.	M	(%)	F	(%)	Unk.	Total
1991-92															
Fall 91	21	(64)	12	(36)	0	33	--	--	--	21	(64)	12	(36)	0	33
Spring 92	35	(83)	7	(17)	0	42	--	--	--	35	(83)	7	(17)	0	42
Total	56	(75)	19	(25)	0	75	2	4	0	58	(72)	23	(28)	0	81
1992-93															
Fall 92	36	(57)	27	(43)	0	63	--	--	--	36	(57)	27	(43)	0	63
Spring 93	36	(77)	11	(23)	1	48	--	--	--	36	(77)	11	(23)	1	48
Total	72	(65)	38	(35)	1	111	1	2	1	73	(65)	40	(35)	2	115
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

[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, 1987–96

Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Successful hunters[b]
1987-88	3	(4)	47	(61)	27	(35)	77
1988-89	3	(4)	42	(57)	28	(38)	73
1989-90	12	(12)	49	(50)	37	(38)	98
1990-91	12	(14)	49	(50)	35	(41)	85
1991-92	4	(5)	34	(45)	37	(49)	75
1992-93	19	(17)	56	(50)	33	(30)	111
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

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

Table 3 Unit 13 brown bear harvest chronology by month, 1991–96

	Harvest periods												
Regulatory	August		September		October		November		April		May		*n*
year	%	*n*	%	(n)	%	*n*	%	*n*	%	*n*	%	(n)	
1991-92			43	(32)	1	(1)	--	--	38	(28)	18	(13)	74
1992-93			45	(50)	12	(13)	0	0	28	(31)	15	(17)	111
1993-94			53	(35)	11	(7)	0	0	23	(15)	14	(9)	66
1994-95	1	(1)	52	(50)	7	(7)	0	0	25	(24)	15	(15)	97
1995-96	35	(44)	38	(49)	5	(6)	1	1	10	(13)	11	(14)	127

Table 4 Unit 13 brown bear harvest percent by transport method, 1991–96

Regulatory year	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Walk	Unk.	*n*
1991-92	41	3	4	0	19	13	11	3	7	75
1992-93	37	2	4	11	16	5	11	10	4	111
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

LOCATION

GAME MANAGEMENT UNIT: 14 (6,625 mi^2)

GEOGRAPHIC DESCRIPTION: Upper Cook Inlet

BACKGROUND

Urbanization, agricultural development, and remote settlement have influenced brown bear density and distribution. The range of estimated brown bear numbers since 1990 has been 168–262 (Grauvogal 1990, Griese 1991, Harkness 1993). Harkness refined the Unit 14 brown bear population estimate to 185–239 bears.

The annual allowable harvest (AAH) of 10 bears and/or 3 independent females was exceeded in all years during 1987–1993, except in 1993 when only 6 bears were reported killed. Since 1987 the number of bears killed has ranged from 6 to 18 bears; 1–8 bears were killed unrelated to hunting.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

Since 1976 Subunit 14A goals were to provide the maximum opportunity to participate in hunting brown bears and, secondarily, to provide for optimum harvests of brown bears. In Subunit 14B the goal was to provide maximum opportunity to participate in hunting brown bears. And in Subunit 14C the goals were 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 seems largely unaffected by human harvest.

Human-Use Objectives

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

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 extracted for age determination, and information on date and location of kill and hunter effort collected from successful hunters. We compared harvest data with harvests in previous years.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

A lack of field activities hinders insight into population status and trend. However, public reports and human/bear encounters indicate that bears may be as common, or more so, as they were 15 to 20 years ago, especially in Subunit 14C.

MORTALITY

Harvest

Season and Bag Limit. In Unit 14 the hunting season for brown bears was 15 September through 10 October and 1 May through 25 May. However, within Subunit 14C brown bear hunting is allowed only within "the remainder of 14C," which excludes 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.

Board of Game Actions and Emergency Orders. During the spring 1997 Board of Game meeting, the Board liberalized the Unit 14B brown bear seasons. For regulatory year 1997 the new season will run from 25 September through May 25. The season was liberalized at the request of a hunting guide from the unit.

Hunter Harvest. During the report period hunters reported a unit average annual harvest of 8 bears, the same as the previous 2-year period; however, the female component increased to 56% (Table 1). The harvest was distributed between Unit 14A (2 males, 5 females) and Unit 14B (5 males, 4 females). Hunters in Subunit 14C have harvested no bears since 1986.

Hunter Residency. All 16 hunters who reported killing a brown bear during this period were Alaska residents and most successful hunters were local residents (Table 2).

Harvest Chronology. Although harvest chronology in Unit 14 has been variable since 1991, harvest usually occurred during September or the first 2 weeks of May (Table 3). By contrast, hunters harvested few bears during the October and late May open season periods.

Transport Methods. During the report period successful brown bear hunters used boats, highway vehicles, and ATVs (other) for transportation (Table 4). During 1991 to 93 airplanes were the dominant means for transporting successful hunters.

Other Mortality

During the report period defense of life or property kills totaled 8 bears. Six of those were killed in Subunit 14A and one each in 14B and 14C. The bear killed in 14C was an independent female; the others were males or of unknown sex. During the report period we received no reports of brown bears killed by trains or highway vehicles.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Human Mortality by Bears

On 1 July 1995, 1 (or more) unidentified brown bear fatally mauled 2 adults, apparently defending a moose-kill in Unit 14C within Chugach State Park. Followed by his mother and nephew, a man was jogging on a park trail through heavy alders. The woman and her grandson apparently surprised the bear(s). The nephew escaped down hill through the alders. He found his uncle some time later and informed him they had been separated by a "moose" attack. The man then also encountered the bear(s) while searching for his mother (R. Sinnott, pers. commun.).

In response to the attack, the area biologist and regional supervisor developed a new policy on bear maulings in the Anchorage area. The area biologist or his/her designee would carry a pager at all times between the period of 1 May to 15 November. Alaska State Troopers and Anchorage Police Department dispatchers will notify the area biologist or designee immediately in the event of a bear mauling. They will then search the area as soon as possible by helicopter to locate and radiocollar any bear that may have been involved. Hair follicles to establish a DNA "fingerprint" will be collected and matched against evidence at the scene of an attack. Meanwhile, a group including the area biologist, management coordinator, regional supervisor, and a bear biologist will determine if the same bear is likely to attack again. If so, the bear will be destroyed (R. Sinnott, pers. commun.).

Brown bears are increasingly observed killing moose (both calves and adults) in Anchorage. The female bear shot in DLP in Subunit 14C had pursued and killed moose calves for about 6 weeks in residential areas of the Anchorage Hillside. At least 7 calves were found and removed from residential areas before the bear returned to finish eating them. Two young brown bears were captured on Fort Richardson in summer 1995 and relocated to the Kenai Peninsula. These bears were behaving normally and were not associated with garbage or human foods; however, their presence (and predatory activities) in residential areas could not be tolerated (R. Sinnott, pers. comm.).

CONCLUSIONS AND RECOMMENDATIONS

Management objectives are highly subjective but appear to have been met, while human-use objectives were not met. AAH was exceeded during 1995 both in numbers of reported bears killed (14, including hunting and nonhunting) and in number of independent females killed (5). Since 1987, AAH of bears has been exceeded in all years except 1993 (6) and 1994 (10). Unlike the total bear AAH, the independent female AAH was exceeded only during 1987 (4), 1991 (5), 1992 (4), and 1995 (5).

In effect since 1993, changes in the bear hunting season have been partially successful in attaining human-use objectives. Fall hunting season dates were delayed and reduced from a 1 September opening to an opening on 15 September. However, added to the fall season was a spring season during 1 May–25 May (a May 10–25 season had previously existed in 14B). While the number and type of nonhunting killed bears were not influenced by these changes to hunting regulations, season dates that directed hunter opportunity to the period when sows were less

vulnerable and when rate of incidental harvest was diminished appeared to reduce total harvests and independent female harvests.

Future modifications to season dates should also strive to reduce overlap of moose hunting seasons. Such was the case for changes made to Subunit 14B season dates during the 1997 spring Board of Game meeting. In adding bear harvest dates between 10 October and 1 May, fall hunting during 15–24 September was eliminated. This is expected to maintain allowable harvest levels.

Because of human population growth and associated development of previously wild lands, we need to reevaluate our goals and objectives for the brown bear population. The human population in Unit 14, specifically Subunits 14C and 14A, are the greatest in the state. Anchorage residents and those in the Mat-Su Valley exceed 310,000. As this population grows residents also settle, recreate in, and develop the edge of Alaska's wild places. Land development, while near maximum in Subunit 14C, is rapidly increasing in Subunit 14A and moderately increasing in 14B. Diminishing large tracts of undeveloped public lands and increasing human recreational use of Chugach State Park will adversely affect human tolerance for even low bear populations. Development, particularly in critical areas such as salmon streams, is expected not only to diminish the availability of important feeding areas to bears but also to increase the probability of contact between bears and humans. Contacts are inevitable if bear numbers are allowed to grow or remain stable concurrently with human growth. Anticipating inevitable conflicts and managing bear numbers to avoid bear-human clashes, even in park settings, may become a function of the department.

Human use and development of lands in the Municipality of Anchorage and Palmer–Wasilla may conflict with brown bear population objectives. Anchorage residents are currently being polled to measure their regard and tolerance for wildlife in the Anchorage bowl. Gathering responses to these questions are the first stage of a planning process to address the appropriateness of current bear population objectives. We should also reevaluate appropriateness of population objectives elsewhere in Unit 14.

In developing a new 5-year management plan for brown bears in Unit 14, we may need to recognize that most unit residents appreciate the chance to see a brown bear but are also concerned about their own personal safety. Residents appear to tolerate some risk in Chugach State Park and other large undeveloped areas but are much less tolerant of bears in residential areas and municipal parks, which they perceive as human habitat. Based on public perception of recent maulings and preliminary results of the Anchorage wildlife questionnaire, most residents seem to disapprove of destroying a bear if it was defending its cubs or a food source, unless the bear continues to be a significant threat (R. Sinnott, pers. commun.). Frequency of human/bear encounters is related to bear densities and human use of bear habitat. A new management strategy should consider reducing bear numbers in specific zones through hunting opportunities or department actions. Thus management objectives should perhaps no longer reflect a desire for no change in bear numbers ("...seem largely unaffected by human harvest") but reflect the acceptance of an appropriate reduction in or near urban areas.

Resource planning for bear management should include the department's fishery divisions because many of their stocking actions and allowance for fishing in spawning areas promote undesirable interactions between anglers and bears. Enhancing and creating new runs of salmon have attracted brown bears to Anchorage-area streams and Eagle River. Anglers and other recreationists heavily use these streams that are occasionally used by bears as movement corridors into urban areas. As a minimum educational effort, fishery divisions should be convinced to publish in their fishing regulations "bear facts" and specifics of the defense of life or property regulation. This is clearly an educational tool that is being ignored.

We should be conducting a strong educational program to inform Alaskans and visitors to the state how to act around bears and to recognize undesirable interactions. Current approaches seem to be inefficient at reaching and training most people. We have not fully used the television and radio media, likely to reach many Alaskans.

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Table 1 Unit 14 brown bear harvest, 1991–95

Regulatory	Reported								Estimated unreported	Total estimated kill				
	Hunter kill					Non-hunting kill[a]								
year	M	F	(%)	Unk.	Total	M	F	Unk.	kill	M	(%)	F	(%)	Unk.	Total
1991														
Fall 91	7	5	(42)	0	12	4	1	0	1	11	(65)	6	(35)	1	18
Spring 92	1	0	(0)	0	1	0	0	0	0	1	(100)	0	(00)	0	1
Total	8	5	(38)	0	13	4	1	0	1	12	(67)	6	(33)	0	19
1992														
Fall 92	4	3	(43)	0	7	2	2	0	1	6	(55)	5	(45)	1	12
Spring 93	2	2	(50)	0	4	0	0	0	0	2	(50)	2	(50)	0	4
Total	6	5	(45)	0	11	2	2	0	1	8	(53)	7	(47)	1	16
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

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

Table 2 Unit 14 brown bear successful hunter residency, 1991–95

Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total successful hunters
1991	9	(69)	0	(0)	4	(31)	13
1992	7	(64)	0	(0)	4	(36)	11
1993	5	(100)	0	(0)	0	(0)	5
1994	5	(100)	0	(0)	0	(0)	5
1995	10	(91)	1	(9)	0	(0)	11

[a]Unit 14 residents

Table 3 Unit 14 brown bear harvest chronology percent by month, 1991–95

Regulatory year	Harvest periods						
	September		October		May		
	1-15	16-30	1-15	16-31	1-15	16-31	*n*
1991	46	31	15	0	0	8	13
1992	9	55	0	0	18	18	11
1993	0	40	0	0	40	20	5
1994	0	20	0	0	60	20	5
1995	18	45	18	0	18	0	11

Table 4 Unit 14 brown bear harvest percent by transport method, 1991–95

Regulatory year	Percent of harvest						
	Airplane	Horse	Boat	ORV	Highway vehicle	Other/ Unknown	*n*
1991	38	8	8	15	15	15	13
1992	36	0	9	8	18	18	11
1993	0	0	0	40	20	40	5
1994	0	0	40	20	20	20	5
1995	9	0	27	0	36	27	11

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. Brown bear densities range 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 have tracked harvest data to estimate population trends.

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 60 to 84 bears, exhibiting a general declining trend. During 1993, a poor hunting-weather spring and a low fall hunter population, harvest reached only 40 bears. Moose hunter participation declined in fall 1993 due to newly enacted antler restrictions (Griese 1995).

Griese (1993) estimated an annual sustainable harvest of 55 bears including no more than 18 females >2 years old. The annual harvest during 1984–1992 exceeded sustainable levels, although the >2-year-old female harvest was not exceeded every year. Harvest of females >2 years old did not exceed objective levels during 1988 (16), 1989 (16), and 1993 (13). 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 department had recommended reducing the length of the bear hunting season and providing for population stability. The Board determined that moose was the priority species in Unit 16, and a high population of brown bears compromised high moose productivity. The brown bear population objective was modified to reflect the Board of Game's priority (Griese 1995).

MANAGEMENT DIRECTION

Management Goals

Allow a sustainable harvest of bears when not in conflict with retaining desirable predator/prey ratios.

Population Objectives

Maintain a brown bear population that appears stable or slightly declining.

Human Use Objectives

Allow optimum opportunity to hunt brown bears while allowing a 3-year average harvest of 50 to 60 bears, including a 3-year average of no more than 18 females >2-year-olds.

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 hunter transportation.

In reevaluating management objectives and the allowable harvest of bears from the Unit 16 brown bear population, I made the following assumptions when calculating the allowable harvest of females>2 years old: a conservative population estimate of 700 bears >2 years old, a skewed sex composition (65% females), and that all other Unit 16 population parameters were similar to those used by Miller (1988) for Unit 13. I allowed for a 5% excessive harvest to allow a slight decline.

RESULTS AND DISCUSSION

Population Status and Trend

Now there are direct measures of trend or status of the brown bear population. Harvest trends indicated a population decline, while comments from unit residents and visitors to Unit 16 suggested a stable or growing brown bear population.

Population Size

The population was estimated within the range of 586–1156 bears (Griese 1993).

Mortality

The most recent, 1993 to 95, reported 3-year average annual brown bear kill in Unit 16 was 49.7 bears. Included in this number were 12.0 females >2 years old. Both numbers were within human-use objectives for this period. Estimates of unreported kills, from wounding loss and poaching, (Tables 1 and 2) add an additional 4 bears annually to the average, which is still within objectives. Hunters accounted for 95% of the reported harvest.

Age and Skull Size of Sealed Bears. The most recent 3-year average age of male bears was measured at 6.2 years (n = 91), and the average skull size was 22.8 inches (n = 92). These measurements reflected a continued decline from 1984 to 1986 when average age of males was 7.6 years (n = 153) and skull size was 23.4 inches (n = 140). The average age of female bears for this period was 5.0 years (n = 45), and average skull size was 19.6 inches (n = 47).

Harvest

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. Cubs and females accompanied by cubs were not legal to take.

Board of Game Actions and Emergency Orders. During the March 1994 Board of Game meeting, the board did not pass my proposal to shorten the fall hunting season (open 15 September) to reduce the potential for excessive harvest of females. The board determined that moose were the priority game animal in the unit and that high numbers of brown bears conflicted with the priority.

During the March 1997 Board of Game meeting, the board adopted a longer bear season within the Denali State Park portion of Subunit 16A. The new season will be 1 September–31 May. This change was a compromise with conflicting seasons and bag limits with the Subunit 13E portions of the park.

Hunter Harvest. Hunter harvest increased slightly from the low harvest during 1993 in both Unit 16A (Table 1) and 16B (Table 2). The increase came primarily during the fall season; spring harvest remained low. The average harvest for the reporting period was 6.5 bears in Unit 16A and 44.5 bears in Unit 16B. The harvest of bears in Unit 16A was essentially unchanged since 1984 and 1985 but in 16B harvest was almost half that during 1984 and 1985.

Hunter Residency and Success. The composition of successful hunter residency during this report period changed little from previous years. Nonresident hunters harvested 50–59% of bears killed, while nonlocal Alaska residents claimed 37–44% (Table 3). Unit residents killed 4–6% of the bear harvest.

Harvest Chronology. In spring, harvest of bears was again concentrated in April while peak fall harvest was concurrent with moose seasons and was mostly in September (Table 4).

Transport Methods. The airplane remained the preferred method of transportation by successful brown bear hunters (Table 5). During the report period 66–71% of successful hunters used aircraft. While fears that snowmachine technology would allow more hunters to successfully take bears in the unit, poor snow conditions in recent springs have delayed any apparent influence on the total harvest.

Other Mortality

During 1995, 6 bears were killed illegally or in defense of life or property (DLP). One female was illegally killed in Subunit 16A while 3 bears, 1 male and 2 of unknown sex, were reported illegally killed in 16B. A young female and 1 young male bear were killed DLP in 16B.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Fishing activities on rivers and streams in the unit continued to promote dangerous interactions between humans and bears. The issue of bear/human conflicts needs resolution and is exemplified by the Big River Lakes sockeye salmon sport fishery. Anglers attracted by the

promise of easy limits and/or bear viewing opportunities concentrate in an extremely small section of the water system. Bears, likewise, concentrate for easy fishing and "panhandling" anglers. Hand-feeding of bears, leaving fish and fish parts along the shoreline, and reeling in fish while bears were present are common practice at this remote site.

In hopes of educating visitors, we mailed a letter to air taxi and lodge owners who had clients using this site. The letter recommended briefings by the operators to their clientele on fishing etiquette in bear country. Few responses to the letter were received but calls about problems diminished.

CONCLUSIONS AND RECOMMENDATIONS

The management objective appeared to be met, although measurement of the predator/prey ratio was not attempted, and the human-use objective was not exceeded during this report period. Bear harvests in Unit 16 were affected by spring snow and weather conditions and low interest in participating in a restrictive fall moose season. Both factors were likely responsible for reduced harvest levels beginning in 1993.

Recent interest in standardizing management goals and objectives will lead to recommended modification of goals and objectives for Unit 16. A report on a September 1994 bear management workshop defined uniform parameters for measuring harvest as it relates to population goals. The measuring unit recommended was 'females >2 years old' without total harvest (K. Schneider, meeting minutes). Recommendations for both goals and objectives for brown bears indicate that harvest of males can be ignored unless maintenance of large male harvests are an objective. In addition, sustainable harvest rates were clarified for use in management applications. A model-tested sustainable rate of harvest of females >2 years old for the population of bears >2 years was 5.8% (Miller 1988).

In response to these recommendations, I submit the following proposed changes:

MANAGEMENT GOAL: To reduce the number of breeding bears by providing enhanced opportunities to hunt brown bears.

MANAGEMENT OBJECTIVE: To allow human use to reach a maximum of 28 females >2 years old harvested, based on a 3-year running average.

As identified in previous management reports (Griese 1993, Griese 1995), I continue to recommend an orchestrated planning process that addresses bear management direction for Unit 16 and encourage the participation by the department's fisheries divisions. In the absence of a reliable, affordable survey technique for brown bears, I also continue to recommend mandatory reporting of hunter effort by unsuccessful hunters.

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Table 1 Unit 16A brown bear harvest, 1991–95

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
1991															
Fall 91	8	1	(11)	1	10	0	0	0	1	8	(89)	1	(11)	2	11
Spring 92	3	0	(0)	0	3	0	0	0	1	3	(100)	0	(0)	1	4
Total	11	1	(3)	0	13	0	0	0	2	11	(92)	1	(33)	3	15
1992															
Fall 92	3	4	(57)	0	7	1	3	0	1	4	(36)	7	(64)	1	12
Spring 93	5	0	(0)	0	5	0	0	0	0	5	(100)	0	(0)	0	5
Total	8	4	(33)	0	12	1	3	0	1	9	(56)	7	(44)	1	17
1993															
Fall 93	0	0	(0)	0	0	0	0	0	0	0	(0)	0	(0)	0	0
Spring 94	2	0	(0)	0	2	0	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	1	3	(75)	1	(25)	1	5
Spring 95	1	2	(67)	0	3	0	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	1	(33)	2	(67)	1	4
Spring 96	2	2	(50)	0	4	0	0	0	0	2	(50)	2	(50)	0	4
Total	3	3	(50)	0	6	0	1	0	1	3	(43)	4	(57)	1	8

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

Table 2 Unit 16B brown bear harvest, 1991–95

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
1991															
Fall 91	9	14	(61)	1	24	0	2	0	3	9	(36)	16	(64)	4	29
Spring 92	25	5	(17)	2	32	0	0	0	0	25	(83)	5	(17)	2	32
Total	34	19	(36)	3	56	0	2	0	3	34	(62)	21	(38)	6	61
1992															
Fall 92	18	16	(47)	2	36	0	0	0	3	18	(53)	16	(47)	6	40
Spring 93	19	8	(29)	2	29	0	0	0	1	19	(70)	8	(30)	3	30
Total	37	24	(39)	4	65	0	0	0	4	37	(61)	24	(39)	9	70
1993															
Fall 93	8	12	(60)	0	20	0	1	0	2	8	(38)	13	(62)	2	23
Spring 94	18	0	(0)	0	18	0	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	3	15	(75)	8	(25)	3	26
Spring 95	19	1	(5)	0	20	0	0	0	1	19	(95)	1	(5)	1	21
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	3	14	(41)	20	(59)	5	39
Spring 96	14	1	(7)	0	15	0	0	0	1	14	(93)	1	(7)	1	16
Total	26	20	(43)	0	46	2	1	2	4	28	(57)	21	(43)	6	55

[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, 1991–95

Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total successful hunters
1991	1	(1)	32	(48)	34	(51)	67
1992	5	(6)	31	(40)	38	(49)	77
1993	2	(5)	8	(20)	30	(75)	40
1994	2	(4)	18	(37)	29	(59)	50
1995	3	(6)	22	(44)	25	(50)	52

[a]Unit 16 residents

Table 4 Unit 16 brown bear harvest chronology percent by month, 1991–95

Regulatory year	Harvest periods						
	September %	October %	November %	March %	April %	May %	*n*
1991	38	10	0	0	40	12	68
1992	49	6	0	1	31	12	77
1993	43	8	0	3	45	3	40
1994	50	4	0	4	32	10	50
1995	46	15	2	0	27	10	52

Table 5 Unit 16 brown bear harvest percent by transport method, 1991–95

Regulatory year	Percent of harvest							
	Airplane %	Horse %	Boat %	Snowmachine %	ORV %	Highway vehicle %	Other/ Unknown %	*n*
1991	62	4	9	9	2	3	12	68
1992	75	0	8	1	5	3	8	77
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

LOCATION

GAME MANAGEMENT UNIT: 17 (18,800 mi^2)

GEOGRAPHIC DESCRIPTION: Northern Bristol Bay

BACKGROUND

Although brown bears are common throughout the northern Bristol Bay area, there have been no research activities conducted in Unit 17. Consequently, we do not have a complete understanding of the density, key denning areas, and other aspects of the bear population. Brown bears 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. We also see bears near aggregations of caribou throughout the range 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 been less hunting pressure. Annual reported harvests have rarely exceeded 50 bears per year. Prior to 1970, few bears were reported 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 was increased hunting pressure on the Mulchatna caribou herd as it nearly quintupled in number during the preceding decade (Van Daele). Reported moose harvests also increased dramatically during this same period. As 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 been declining for 4 of the past 5 years (Figure 2). Harvest data show a declining trend in the proportion of males in the annual harvest from 1980/81–1987/88, 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 quite a few nonhunting mortalities that we either discover indirectly or never hear about. Because of the widespread occurrence of these unreported kills, conclusions based solely on reported harvest data must be viewed with caution.

POPULATION OBJECTIVE

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

METHODS

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

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Unitwide brown bear population was probably stable to increasing. This was likely the case in most of Subunits 17A and 17C, and the remote portions of Subunit 17B. Bears living in portions of 17B along the Nushagak and Mulchatna Rivers experience the greatest harvest pressure. I believe this portion of the bear population was declining but now has 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 indicate a population density comparable to that observed in the Susitna River study area (2.79 bears/100 km^2) (Miller et al. 1987). At this density, I estimate a population of roughly 1350 independent (>2 years old) bears in Unit 17.

Distribution and Movements

Little is known about the overall distribution and movements of brown bears in this unit. Bears concentrate along salmon spawning streams throughout the summer and fall, and individual bears and family groups are commonly observed near postcalving aggregations of caribou in June and July. I 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.

Subunits 17(A) & 17(C)	May 10–May Sep 10–Oct. 10	1 bear per 4 regulatory years
Subunit 17(B)	May 10–May 25 Sep 20–Oct 10	1 bear per 4 regulatory years

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

Board of Game Actions and Emergency Orders. No Emergency Orders were issued during this reporting period. However, in spring 1992 the Board of Game and the Federal Subsistence Board adopted regulations allowing subsistence harvests of brown bears in Unit 18 and portions of Subunits 17A and 17B. Subsistence hunters were allowed to take 1 bear per year by registration permit, and a bear tag was not required. Hunters were required to salvage the meat and report their kill to the department. We did not require sealing of hides and skulls if they remained in the unit where they were harvested.

Human-Induced Mortality. During the 1995/96 seasons hunters in Unit 17 reported harvesting 44 brown bears, including 26 males (59%) and 18 females (41%) (Table 1). This harvest was near the mean annual harvest of the previous 5 years (44.8 bears). No bears were harvested in Unit 17 under the provisions of the Western Alaska Brown Bear Management Area since its inception in 1992.

The average skull size of bears harvested in 1995/96 was 23 inches (n = 24) for males and 20.4 inches (n = 16) for females. Four bears (1 male and 3 females) were killed in Subunit 17A, 29 (17 males, and 12 females) were killed in Subunit 17B, and 11 (8 males and 3 females) were reported from Subunit 17C. In the past 5 yrs, 8% of the bears harvested in the unit have been taken in Subunit 17A, 66% in 17B, and 26% in 17C (Table 2).

Hunter Residency and Success. Nonresidents take most of the reported brown bear harvest in Unit 17. During the 1995/96 seasons, nonresidents took 73% of the bears harvested in the unit (Table 3).

Harvest Chronology. Twenty-nine bears were killed during the fall 1995 hunting season and 15 bears were killed during the spring 1996 season. Late September has consistently been the time that 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 transportation (Table 5).

Other Mortality

Five brown bears were killed in defense of life or property in Unit 17 during the 1995–96 regulatory year. One was killed after he charged a moose hunter. Four subadult bears were killed near village residences (2 in Dillingham and 2 in Ekwok). Two additional bears were killed illegally in the Dillingham dump. The individual who shot those bears went into the dump after it closed on the evening before the fall hunting season, intending to shoot and tag a bear. While skinning the first bear, darkness closed in and other bears appeared. He panicked, shot another

bear, and left the dump. His partner called the police to report a wounded bear in the dump. The hunter was convicted of 2 counts of illegal harvest, failure to salvage, and was fined.

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 caribou populations in the unit also provide an abundant food supply for bears. Human settlements are relatively small and unobtrusive, and the increased localized food supplies around these settlements in the form of human food and garbage probably enhance the areas as bear habitat. However, bears utilizing 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 (Units 17A and 18). Bears radiocollared in 1993 and 1994 were tracked at least twice per month. The 1996 collaring project was canceled because of ethical concerns raised by the Association of Village Council Presidents (AVCP). The future of this project is uncertain. The Department, FWS, and AVCP have formed a brown bear management team to explore ways to achieve brown bear research and management objectives while being sensitive to traditional Yup'ik customs.

In an effort 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 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 on nonhunting mortality lessens effective management. The department should develop and pursue other cooperative bear research programs with the FWS and the National Park Service to estimate bear density in at least a portion of the Unit 17.

We should continue efforts to encourage local residents to report all bears killed and educate residents on bear behavior and ways to minimize problems with bears. We must also stress 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 make landfills less attractive 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 October 1997 closure date for the existing dump draws near.

RESULTS AND CONCLUSIONS

The population objective of maintaining a brown bear population that will support a harvest of 50 bears per year is being met although this level of harvest has only been achieved during 4 regulatory years since the inception of mandatory sealing in 1962. Subjective evidence suggests 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 exceeded in most years; the sex ratio of the unitwide bear harvest 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 nonlethal methods to minimize antagonistic bear–human encounters. It is difficult to objectively measure the success of these efforts, but in recent years there seemed some improvement.

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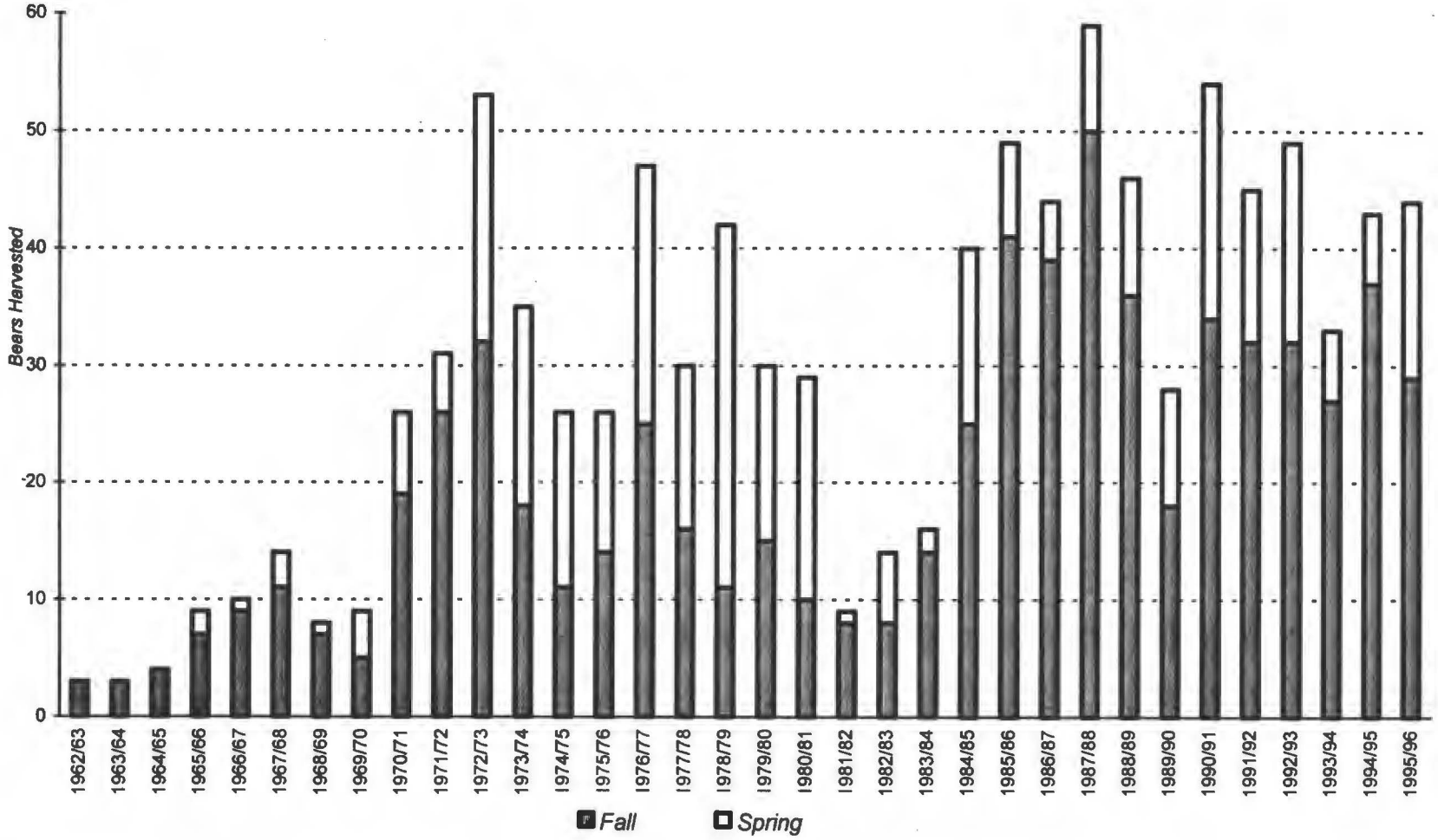

Figure 1. Unit 17 reported brown bear harvest, regulatory years 1962/63–1995/96

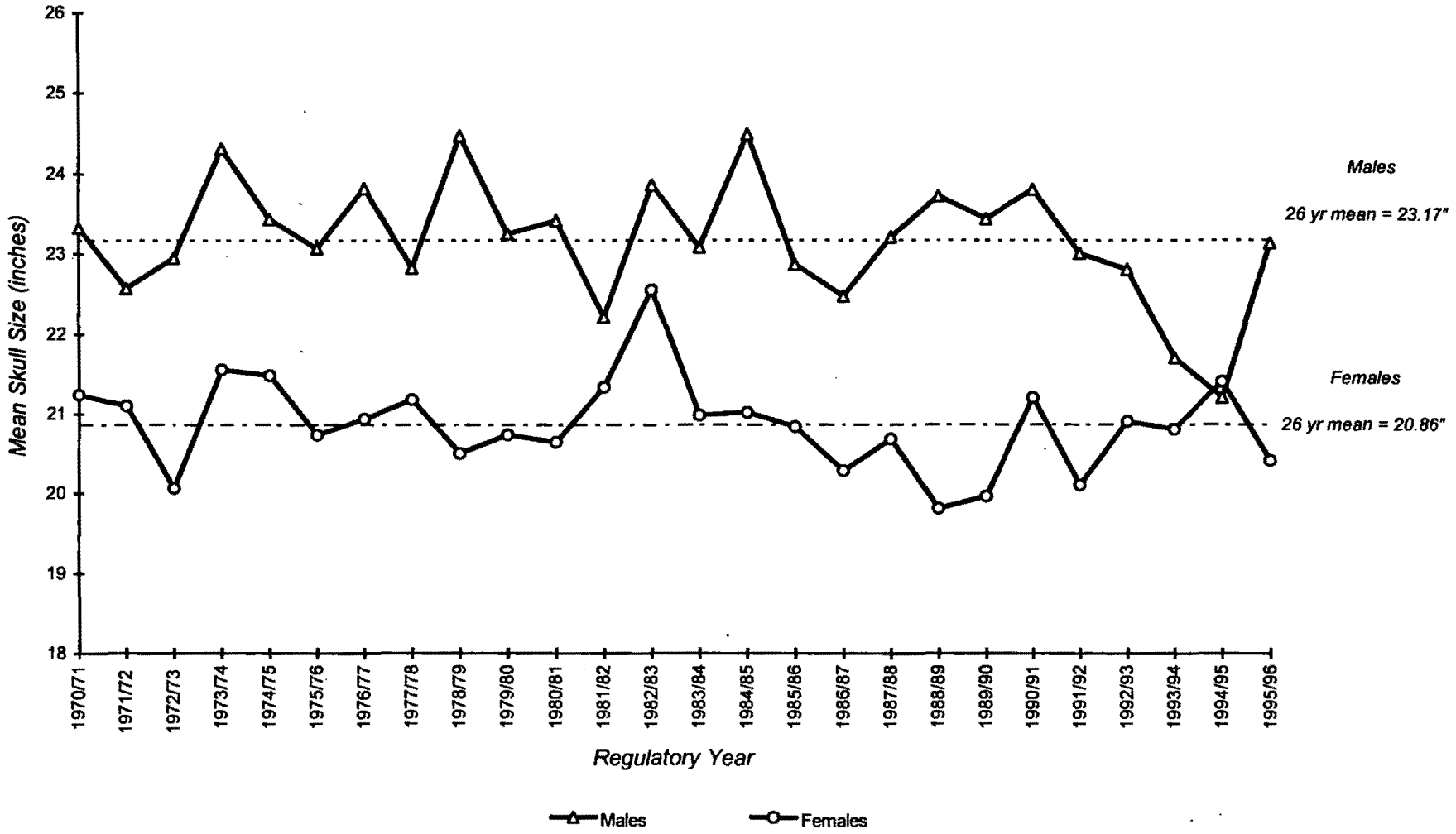

Figure 2. Unit 17 average skull sizes of brown bears, 1970/71–1995/96

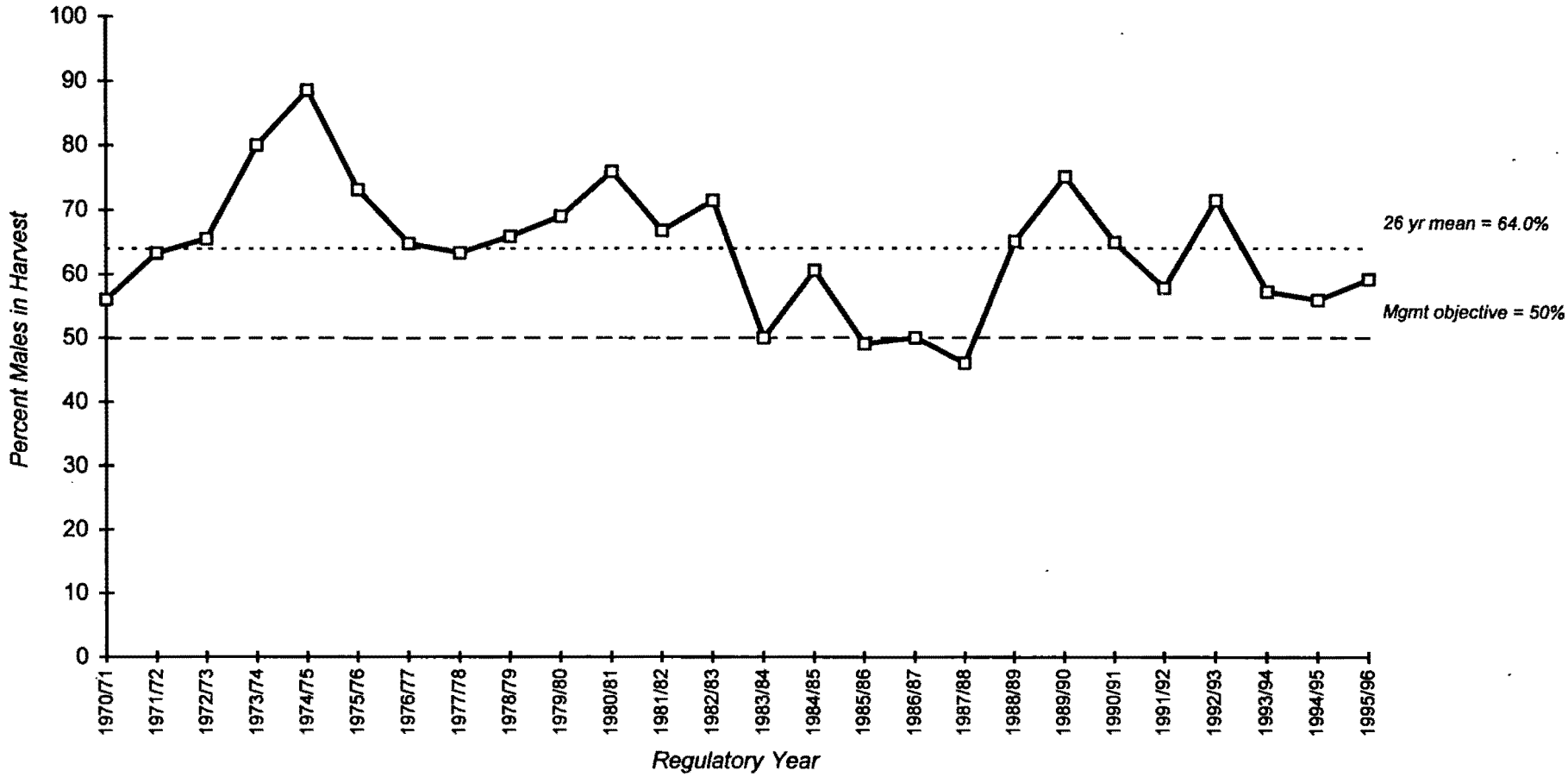

Figure 3. Percentage of male brown bears in the Unit 17 harvest, 1970/71–1995/96

Table 1 Unit 17 brown bear harvest, 1991–96

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	13	2	0	15	0	0	0	0	13	2	0	15
Total	26	18	0	44	2	5	0	7	28	23	0	51

Table 2 Unit 17 brown bear harvest by subunit, 1991–96

Regulatory year	Subunit 17(A) MM	FF	Unk	Total	17(B) MM	FF	Unk	Total	17(C) MM	FF	Unk	Total	Unit 17 total MM	FF	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	17	12	0	29	8	3	0	11	26	18	0	44

Table 3 Unit 17 brown bear successful hunter residency, 1991–96

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	2 (4.5)	10 (22.7)	32 (72.7)	44

[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 month, 1991–96

Regulatory year	Spring season 1-15 APR	16-30 APR	1-15 MAY	16-30 MAY	Fall season 1-15 SEP	16-30 SEP	1-15 OCT	Total
1991/92[a]	----	----	11.1%	15.6%	6.7%	53.3%	11.1%	45
1992/93[a]	----	----	20.4%	14.3%	12.2%	46.9%	6.1%	49
1993/94[b]	----	----	6.1%	12.1%	9.1%	48.5%	24.2%	33
1989/90[b]	----	----	4.7%	9.3%	11.6%	58.1%	16.3%	43
1990/91[b]	----	----	15.9%	18.2%	9.1%	45.5%	11.4%	44

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

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 17(A) and that portion of 17(B) that drains into Nuyakuk and Tikchik Lakes) 1 Sep - 31 May

Table 5 Unit 17 brown bear harvest percent by transport method, 1991–96

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	90.9	---	6.8	---	---	---	2.3	---	---	44

LOCATION

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

GEOGRAPHIC DESCRIPTION: Yukon–Kuskokwim Delta

BACKGROUND

Brown/grizzly bears are moderate in density and stable in number in Unit 18. Highest densities are found in the Kilbuck Mountains southeast of Bethel and in the Andreafsky Mountains/Nulato Hills north of the Yukon River. Average annual harvests vary markedly, with a decline in reported sport harvest continuing between the 1983–1984 and 1992–1995 regulatory years.

The lack of reliable harvest information, except from sport hunters, and a lack of population information and trends warranted development of a reliable and repeatable technique to collect these two types of missing information. For harvest information, we developed a less intrusive method of gathering subsistence brown bear harvest information. To address brown bear population and density, we selected a representative study area in the southwestern portion of Unit 18, where the department could begin 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, comprising 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 US 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 village councils within the management area to better estimate brown bear populations.

MANAGEMENT OBJECTIVES

- Monitor harvests through the sealing program, harvest postcards 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 and recommend to the public methods to minimize bear/human conflicts and to prevent access by bears to human food or garbage. Reducing these garbage and food/bear interactions will reduce bear/human confrontations that risk human injury, death, or often the unnecessary killing of "nuisance" bears.

- Meet with Association of Village Council Presidents (AVCP), subsistence brown bear hunters, and FWS to develop less intrusive and more desirable means to regulate bear hunting by subsistence hunters and to gather brown/grizzly bear harvest information. This is being done through WABBMA regulations and development of 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 develop a study plan to capture/recapture a sample of the bear population in Unit 18 to calculate brown bear densities. Cooperate with local village councils, the AVCP, and the FWS in developing alternative techniques to monitor grizzly bear populations within the WABBMA and Unit 18.

METHODS

Meetings were held between FWS refuge and Subsistence Division staff and Department management staff about the future of cooperative brown bear research within the Yukon Delta and Togiak National Wildlife Refuge, and portions of Units 17B and 18 to estimate brown bear densities. We also discussed the potential for a density estimate and sharing results of bear research in Unit 18 at village meetings and at advisory committee meetings.

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 was begun in 1993. Methods used in this effort are a capture-recapture technique for bears, developed by Miller et al. (1987). In response to opposition from the public to capturing and handling bears, we significantly reduced the collaring effort during the reporting period. During the 1994 study year, it was decided the department and the FWS would review and consider any valid alternative brown bear study brought forth by the village councils, AVCP, and their contract biologist Dr. Charles Jonkel.

During June 1993, the first year of the radiocollaring project, 63 brown bears were sighted, 39 bears were captured, and 26 bears were radiocollared in a 3760-km^2 study area in the southwestern Kuskokwim Mountains. All collared bears were monitored bi-monthly by both department and FWS personnel throughout 1993. During the 1993 study year, 1 June 1993 through 31 May 1994, we found that 4 male bears had shed their collars and 1 female was harvested during the hunting season. All of these collars were retrieved. During 11 and 12 May 1994, the department, FWS, and local village councils from Units 17 and 18 held meetings to address widespread opposition to the handling of brown bears during the capture effort.

Postcards were sent out, along with 1 reminder letter to all subsistence brown bear hunters who registered to hunt in the WABBMA during the 1994–1995 and the 1995–1996 regulatory years. This was a continuing attempt by the department to gather unitwide subsistence brown bear

harvest information. This first attempt to gather such information was initiated during the 1992–1993 regulatory year. 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 and aged. We recorded data on hunter residency, number of days hunted, date of kill, transportation used, and location of kill at the time of sealing. When possible, we investigated 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. Public notices were posted at villages concerning different ways to reduce adverse encounters between bears and the public.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The recent trend appears to be a stable or slightly increasing bear population as it continues to recover from high harvests during the late 1970s and early 1980s, when combined sport harvest and subsistence harvest may have approached 5–10% of the estimated resident bear population.

Although statistically valid bear density estimates have not been made in Unit 18, we do have density estimates completed elsewhere in the state using a modified capture-recapture technique (Miller et al. 1987). The process of developing an estimate for Unit 18 was begun during June 1993. Since the project began in 1993, we have handled 62 brown bears and observed approximately 100 different brown bears within the study area. Until another year of capture effort is completed and we achieve an appropriate sample of marked male bears, a density estimate may not be possible or reliable. During the 4 June 1994 limited trial search effort, we estimated 18% of the brown bear population within the study area surveyed to be radiocollared. For an accurate, statistically valid estimate, approximately 50% of the population needs to be marked. We hope that additional collaring and a density estimate will be completed during FY97 or later.

During 1994 the capture effort was greatly reduced. Only 9 bears were radiocollared in 1994, bringing the number of bears marked to 30. Soon after the capture effort in 1994, 1 female collared bear died, presumably from capture-related causes. The number of bears presently radio-collared is 26 females. The actual number of bears spotted during the 1994 capture was 50 bears, 20 of which were captured. Four of the 20 bears captured were recaptures and another 7 were either juvenile bears or male bears that did not receive radio collars; all captured bears were eartagged and/or tattooed (cubs of the year were not tattooed) with an identification number.

Population Size

Population size estimates must be viewed with caution until a statistically valid estimate is completed in Unit 18. Between 500 and 700 grizzly bears may be within Unit 18, based upon available habitat and previous survey and inventory reports.

Population Composition

Based upon the sample of 56 bears >20 months of age, the composition of bears captured within the Kuskokwim Mountains Brown Bear study area, we found that approximately 62% were females and 38% were males. Based upon pre-molars extracted during the capture operation, the average age for bears >20 months of age is 8.8 years (n = 55). The average age for females (8.9 years, n = 34) was not significantly different from males (8.9 years, n = 21). The capture population age structure of this study shows a lack of some older age classes or adult cohorts (Fig 1). Missing cohorts may be characteristic of brown bear populations because in some years very few offspring are successfully produced or survive. Based upon capture information, there are probably as many brown bears <2 years old as cubs and subadults; however, because of high mortality rates of these age classes and small sample sizes of these particular aged bears, the numbers of these younger bears probably varies greatly each year.

Distribution and Movements

Salmon streams 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. The forested riparian corridors of the Yukon River and tributaries of the Kuskokwim in Unit 18 support moderate densities of brown bears in lowland habitats, which are mostly occupied by black bears. The vast treeless lowland of the Y–K Delta contains very few bears, although dispersal occurs through riparian and delta habitats.

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: One bear every four regulatory years	10 Sep–10 Oct 10 Apr–25 May	
Nonresident Hunters: One bear every four regulatory years		10 Sep–10 Oct 10 May–25 May
Unit 18 - Subsistence Hunt		
Resident Hunters: 1 bear per regulatory year by registration permit in the Western Alaska Brown	1 Sep–31 May	

Bear Management Area for subsistence purposes

Nonresident Hunters: No open season

Board of Game Actions and Emergency Orders. During their spring 1992 meetings, the Alaska Board of Game and the Federal Subsistence Board adopted regulations allowing subsistence harvests of brown bears in Unit 18 and portions of Units 17A and 17B, referred to as the Western Alaska Brown Bear Management Area (WABBMA). Subsistence hunters were allowed to take 1 bear per year by registration permit. Subsistence brown bear hunters now have a 9-month season (1 Sep–31 May), rather than a split fall and spring season, and they no longer have to purchase a $25 big game tag if the meat is used for human consumption. A registration permit replaced the game tag and resembles a harvest ticket, at no cost to the hunter. Subsistence brown bear hunters no longer had to seal bear skulls and hides, unless the hide or skull was exported outside the WABBMA. These regulations are very different from the previous years hunting regulations in Unit 18, when a 60-day season, a 1 bear every 4 years bag limit, a $25 tag fee, and sealing of the skull and hide were required.

Hunter Harvest. During the 1994–1995 regulatory year, the reported harvest was 11 bears (6 subsistence and 5 sport) and during 1995–1996, the reported harvest was 7 bears (4 subsistence and 3 sport). The sex ratio of the harvest for the 1994–1995 regulatory year was 8 males to 3 females; during the 1995–1996 regulatory year, the ratio was 5 males to 1 female.

Reported harvest from Unit 18 from 1970 to 1978 averaged 2.0 bears/year; this figure increased to 14.6 bears/year from 1979 to 1986. The record reported harvest was 23 bears in 1981. Seven bears were reported taken in 1986–1987, 4 bears in 1987–1988, 1 bear in 1988–89 and 6 bears were reportedly taken during the 1989–90 regulatory year. Three bears were reportedly harvested during the 1990–1991 season, and 4 were reported harvested the 1991–1992 season. Annual reported harvest in Unit 18 has never exceeded 30 bears in 1 year, which may indicate bear abundance is less than that of bears in other portions of the state.

Unreported harvest includes both DLP and bears taken for subsistence purposes. 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 to 20 bears in years of 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 normally occurs 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, fish-drying racks, and above ground graveyards bring bears close to humans. Some local residents have a low tolerance for bears near their villages and fish camps. Because of these unreported kills, we must view data based solely on reported harvest with caution.

Hunter Residency and Success. During the 1992–1993 regulatory year, 2 residents and 3 nonresidents took brown bears under the general hunting regulations. During 1993–1994, 3 nonresident hunters harvested bears. The subsistence harvests during 1992–1993 and 1993–1994 were by 7 resident hunters and 4 resident hunters, respectively.

No data for unsuccessful hunters was recorded for the reporting period, so success rates could not be calculated.

Of the 90 WABBMA permits issued during the 1992–93 season, all but 2 were residents of Unit 18 and only 7 that sent in harvest report cards indicated they had been successful. Many of the unsuccessful hunters never entered the field. Bear harvest was often incidental to other subsistence gathering activities. Many of the successful brown bear hunters were not specifically hunting brown bear when they harvested a bear. During the 1993–94 season, 49 hunters obtained WABBMA registration permits, of which 47 were Unit 18 residents; the other 2 were Unit 17 residents (Togiak and Dillingham). The reported harvest was 4 brown bears. Most of the unsuccessful hunters had either not entered the field or had not seen bears while moose and caribou hunting.

Harvest Chronology. During the 1992–93 season 6 bears were harvested during the fall and 6 were harvested in the spring. The total 1993–94 nonsubsistence harvest of brown bears was taken during spring 1994. Interestingly, the overall 1993–94 subsistence harvest of 4 bears took place during fall.

Transport Methods. The guided nonresident hunters used aircraft for transportation. One nonlocal resident hunter used a boat for transportation, the other used aircraft during fall 1992–93. In spring 1993, 4 hunters used snowmachines to harvest bears and 2 used aircraft. During the 1993–1994 season, hunters harvested fall bears using a boat; spring hunters used aircraft for access. Subsistence hunters use snowmachines, boats, and aircraft for transportation. These patterns are typical and have changed little over the last 10 years. Some subsistence hunters used aircraft charters as transport to Salmon Lake, Heart Lake, and the northern Tikchik lakes.

Most of the subsistence hunters in the Goodnews Bay, Platinum, Marshall, and Quinhagak areas use snowmachines to hunt bears, especially during spring. Opportunistic hunting for brown bears is increasing along the Kwethluk, Kisaralik, Kanektok, and Goodnews drainages during moose and caribou hunting seasons when high water levels allow greater access.

Other Mortality

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

HABITAT

Assessment

Unit 18 contains approximately 14,000 km^2 of fair to excellent brown bear habitat in the Kilbuck and Andreafsky Mountain ranges. Additional lowland riparian corridor habitats, surrounded by tundra, support moderate densities of brown bears along the Yukon River and tributaries of the Kuskokwim. The number of brown bears in lowland riparian habitats may be substantial but

awaits comprehensive research. Most brown bear habitat in Unit 18 is protected by the Yukon Delta National Wildlife Refuge; 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 lessen effective management. We need to either continue the current ongoing brown bear density estimate in Unit 18, or encourage researchers to develop alternative methods of deriving accurate bear population information without using capture-recapture techniques that are offensive to the local native Alaskan constituents in rural Alaska. Developing reliable, accurate, and repeatable techniques for gathering subsistence brown bear harvest information is becoming increasingly more important with increasing human populations, both within and outside Unit 18.

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. If significantly inaccurate or incomplete, harvest statistics are impossible to interpret. A large percentage of misreporting probably negates the value of the harvest data in Unit 18 and severely compromises our ability to detect trends in bear populations within particular drainages.

ACKNOWLEDGMENTS

The department would like to acknowledge Randy Kacyon as the Unit 18 Area Biologist who completed all the design, planning, logistics, aerial surveys, data collection, preliminary analysis, and community meetings summarized in this report. Tragically, Randy was killed in an aircraft accident on 30 November 1996 while conducting a moose survey along the lower Yukon River. Randy achieved high standards as a wildlife management biologist and worked closely with other agencies and local residents to develop a high level of trust and respect. Successful management of brown bears in Unit 18 was largely the result of his survey efforts and close working relationships with the residents of Unit 18.

Also, the department thanks Sam Patten for his willingness and thoroughness to help prepare and finalize this report, detailing data collected by Kacyon. Patten's knowledge and previous work experience in Unit 18 helped prepare an accurate summary of departmental activities in Unit 18.

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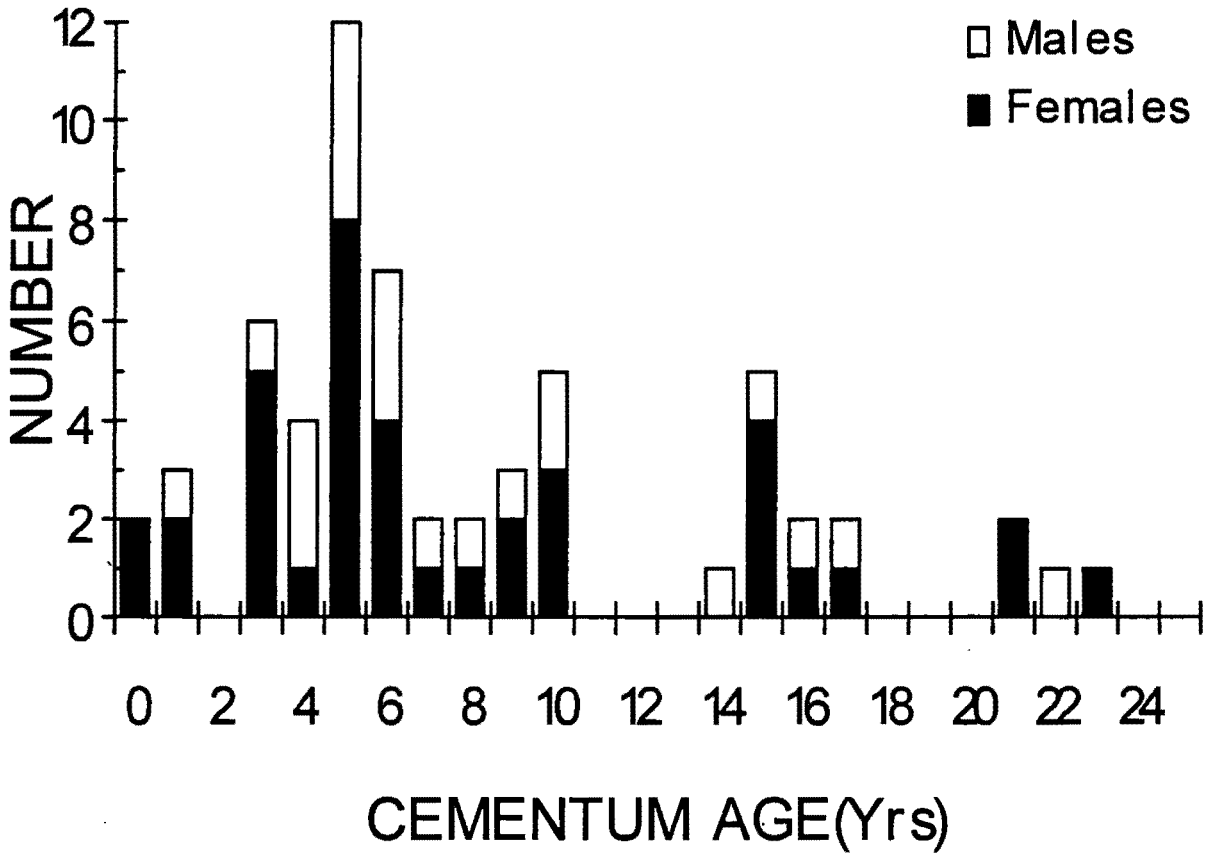

FIGURE 1. Age distribution of brown bears captured in the southwest Kuskokwim Mountains in June 1994. (Bears captured in 1993 but not in 1994 have been added; 1 year was added to their 1993 age).

LOCATION

GAME MANAGEMENT UNIT: 19 (37,000 mi^2)

GEOGRAPHIC DESCRIPTION: All drainages of the Kuskokwim River upstream of the village of Kalskag

BACKGROUND

Although brown/grizzly bears are distributed throughout Unit 19, densities and interest in sport harvest vary. 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 unit.

No population estimation surveys have been conducted in the area; thus, densities are only speculative. Harvests have generally fluctuated with season lengths and probably do not provide a good indication of population level or status. During the first decade following mandatory sealing requirements, harvest was light, averaging about 15 bears annually. During the 1970s, harvest increased dramatically, and seasons were shortened severely, leading to harvest declines by the early 1980s. Throughout the 1980s, harvests remained relatively low but indicated a slowly increasing trend that lasted into the early 1990s.

Brown bear numbers are apparently increasing, based on discussions with area hunters and guides. Increases in population densities and the recent season liberalization have probably facilitated the increasing trend in numbers of brown bears harvested.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

There are 4 consumptive use management goals for brown bears in Unit 19. The goal for that portion of the unit north of the Kuskokwim River is to provide the greatest sustained opportunity to hunt brown bears. In southern Unit 19 the goal is to provide an opportunity to hunt brown bears under aesthetically pleasing conditions. South of the Kuskokwim River upstream from Aniak, the primary goal is to provide opportunity to take large brown bears; the secondary goal in this western part of the unit is to provide opportunity to hunt brown bears under aesthetically pleasing conditions. Finally, the western portion of the unit encompasses a portion of the Western Alaska Brown Bear Management Area, in which subsistence uses of bears have been identified as the priority.

MANAGEMENT OBJECTIVES

- Manage brown bear populations to sustain a mean annual harvest of no more than 30 bears with a minimum of 50% males in the harvest.

- Increase legal harvests 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

No bear population estimation surveys have been conducted in Unit 19. We annually review harvest trend, based on sealing documents, and amend regulations when harvest data indicate a need.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size and Composition

A rough population estimate of 900 brown bears was provided by Pegau (1987). No bear surveys have been conducted since. However, using reasonable density figures for differing qualities of brown bear habitat produces a similar estimate. Unit 19B probably contains about 7500 mi^2 of the best bear habitat, with an estimated density of 40 bears per 1000 mi^2, a total of about 300 bears. Unit 19C has an estimated 5200 mi^2 of good habitat (40 bears/1000 mi^2 = 210 bears) and about 1500 mi^2 of poor habitat (20 bears/1000 mi^2 = 30 bears). Unit 19D generally contains poor habitat (13 bears/1000 mi^2 = 165 bears). Unit 19A has habitat that probably contains about 20 bears per 1000 mi^2, a total of about 200 bears. Using these figures, the total estimate is 905 brown bears for Unit 19. With about 37,000 mi^2 in the area, an overall density of 24 bears per 1000 mi^2 is calculated.

Because no formal survey work has been conducted, the trend of the Unit 19 brown bear population is not well documented. From analyses of harvest data, the present human use of the brown bear population is probably moderate. Assuming that the above calculations are reasonably accurate, the 5-year mean annual harvest (1991–1996) of 48 brown bears constitutes a harvest of about 5% of the total population.

MORTALITY

Harvest

Following relatively low harvests throughout the 1960s (1961–1970 mean annual harvest = 15.2 bears), there was an increase through the 1970s (1971–1980 mean annual harvest = 53.7). From 1981–1990, reported annual harvests were moderate when compared to the 2 earlier decades (1981–1990 mean annual harvest = 28 bears). During the early 1990s (1991–1993) the harvest again increased (mean annual harvest of 45 bears), probably in response to increased season lengths (Table 1).

Season and Bag Limit. The following season and bag limit were in effect for the 1995–1996 regulatory year.

Units and Bag Limits	Subsistence Open Seasons	Resident/Nonresident Open Seasons
Units 19A and 19B; those portions within the Western Alaska Brown Bear Management Area. One bear every regulatory year. Hunters must register to hunt.	Subsistence only 1 Sep–31 May	No open season
Units 19A, 19C, and 19D. One bear every 4 regulatory years.	1 Sep–31 May	1 Sep–31 May
Unit 19B. One bear every 4 regulatory years.	10 Sep–25 May	10 Sep–25 May

Board of Game Actions and Emergency Orders. Beginning with the 1990 regulatory year, the Board of Game authorized a longer season throughout Unit 19. Rather than having split fall and spring seasons totaling 46–56 days, the board made minor changes to fall opening and spring closing dates and elected to leave the winter period open. Initially, it seems season length increased almost 5-fold; however, because of winter denning, it is obvious that effective brown bear hunting opportunities will change little. I suspect that increased season lengths will only slightly increase harvest, comprising mostly males taken in May.

Sex Ratio in the Harvest. Because present harvest is thought to be low enough that population impacts from hunting are negligible, annual sex ratios of harvested bears have fluctuated. Generally, the proportion of males in the harvest has been near 60% (Table 2). During only 2 of the past 10 years has the male:female sex ratio been less than 1:1, with the 10-year mean percentage of males at 58.4%. The percentage of males in the reported harvest varied from a low of 29% (1966) to a high of 77% (1971) during the 33-year period from 1961–1993. Generally, it is assumed that a preponderance of males in the harvest reflects a healthy population, given low to moderate hunting pressures. However, many Unit 19 brown bears are harvested on multi-species 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 brown bear hunting effort becomes more intensive in Unit 19, a management scheme designed to harvest greater than 50% males should afford protection necessary to sustain the population.

Hunter Residency and Success. During the past 35 years while sealing has been mandatory, 986 of 1266 bears (78%) were harvested by nonresidents of the state, and in only 1 year has reported nonresident harvest been less than 50% of the harvest (Tables 3 and 4). This further 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 annually between 1990 and 1993 has shown a decline, indicating that hunters are spending less time each year to harvest a bear (1990 = 7.45 days; 1993 = 4.57 days).

Harvest Chronology. From 1961 to 1989, 149 of 954 harvested bears (16%) were reported taken during spring (Table 5). From 1990 to 1995, 54 of 278 (19%) harvested bears were taken during spring, increasing spring harvests with less restrictive spring seasons.

Transport Methods. Of successful hunters who listed method of transportation on their sealing documents between 1961 and 1995, 954 of 1068 (89%) used airplanes as their primary access method (Table 6). This percentage has not changed significantly since sealing began.

CONCLUSIONS AND RECOMMENDATIONS

Because current seasons and bag limits are allowing a moderate brown bear harvest and there are no apparent signs of decline in the population (based on sealing documents, mean annual ages of harvested bears, days hunted per successful hunter, and sex ratios), additional harvest restrictions seem unnecessary. However, following the longer seasons authorized by the Board of Game in 1990, close annual scrutiny of harvest data must occur and changes enacted if warranted. Brown bear predation on moose, caribou, or bison is not an apparent widespread problem in the unit.

We will continue annually reviewing sealing certificate data. If sex ratios in the harvest begin to favor females, we should consider changes in season lengths. Mean ages of harvested bears fluctuated annually, but it seems the older-aged cohorts of the population remain intact.

ADF&G and FWP personnel will continue personal contacts in villages and fish camps to urge local residents to document harvests, whether legal or taken under DLP provisions. Because of the present regulation requiring a $25 resident brown bear tag (except for residents hunting within the Western Alaska Brown Bear Management Area), compliance with reporting requirements by local residents is low. Perhaps allowing state residents to harvest a bear, then retroactively obtain the necessary tag would increase reporting.

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Table 1 Annual harvest of brown bears by subunit in Unit 19, 1984–1995

Regulatory year	Subunits					Total
	A	B	C	D	Z[a]	
1984	4	7	11	1	0	23
1985	4	12	4	3	0	23
1986	4	12	9	1	0	26
1987	5	18	12	2	0	37
1988	3	10	16	1	0	30
1989	0	15	16	3	0	34
1990	2	15	14	7	0	38
1991	4	18	9	2	0	33
1992	11	28	15	4	0	58
1993	4	25	14	1	0	44
1994	8	25	15	2	0	50
1995	6	29	18	1	1	55
Total	55	214	153	28	1	451
$\bar{x}$	4.6	17.8	12.8	2.3	0.1	37.6

[a] Subunit unknown.

Table 2 Unit 19 brown bear harvest, 1984–1995

Regulatory year	Hunter kill				Nonhunting kill				Total estimate				Grand total
	M	F	Unk	Total	M	F	Unk	Total	M	(%)	F	(%)	
1989-1990													
Fall 1989	10	18	3	31	0	0	0	0	10	(36)	18	(64)	31
Spring 1990	2	1	0	3	0	0	0	0	2	(67)	1	(33)	3
Total	12	19	3	34	0	0	0	0	12	(39)	19	(61)	34
1990-1991													
Fall 1990	15	9	0	24	0	0	0	0	15	(63)	9	(37)	24
Spring 1991	8	5	1	14	0	0	0	0	8	(62)	5	(38)	14
Total	23	14	1	38	0	0	0	0	23	(63)	14	(38)	38
1991-1992													
Fall 1991	11	12	2	25	0	0	0	0	11	(48)	12	(52)	25
Spring 1992	6	2	0	8	0	0	0	0	6	(75)	2	(25)	8
Total	17	14	2	33	0	0	0	0	17	(55)	14	(45)	33
1992-1993													
Fall 1992	28	18	3	49	0	0	0	0	28	(61)	18	(39)	49
Spring 1993	7	2	0	9	0	0	0	0	7	(78)	2	(22)	9
Total	35	20	3	58	0	0	0	0	35	(64)	20	(36)	58
1993-1994													
Fall 1993	20	17	0	37	0	0	0	0	20	(54)	17	(46)	37
Spring 1994	5	2	0	7	0	0	0	0	5	(71)	2	(29)	7
Total	25	19	0	44	0	0	0	0	25	(57)	9	(43)	44
1994-1995													
Fall 1994	23	17	1	41	0	0	0	0	23	(58)	17	(42)	41
Spring 1995	6	3	0	9	0	0	0	0	6	(67)	3	(33)	9
Total	29	20	1	50	0	0	0	0	29	(59)	20	(41)	50
1995-1996													
Fall 1995	29	18	1	48	0	0	0	0	29	(61)	18	(39)	48
Spring 1996	5	2	0	7	0	0	0	0	5	(71)	2	(29)	7
Total	34	20	1	55	0	0	0	0	34	(63)	20	(37)	55

Table 3 Unit 19 residency of successful brown bear hunters residency, 1989–1995

Regulatory year	Resident	(%)	Nonresident	(%)	Unk Resident	Total successful hunters
1989	5	(15)	29	(85)	0	34
1990	5	(13)	33	(87)	0	38
1991	8	(24)	25	(76)	0	33
1992	17	(29)	41	(71)	0	58
1993	8	(18)	36	(82)	0	44
1994	14	(29)	35	(71)	1	50
1995	8	(15)	45	(85)	2	55

Table 4 Percent of nonresident successful brown bear hunters in Unit 19, 1989–1995

Year	Number of nonresidents	Percent nonresidents	Total number successful hunters
1989	29	85	34
1990	33	87	38
1991	25	76	33
1992	41	71	58
1993	36	82	44
1994	35	71	50
1995	45	85	55

Table 5 Unit 19 brown bear harvest chronology percent by month, 1989–1995

Regulatory year	Month of harvest						*n*
	Sep	Oct	Nov	Apr	May	Other	
1989	76	15	0	0	9	0	34
1990	61	5	0	8	26	0	38
1991	67	6	0	12	12	3	33
1992	79	3	2	2	12	2	58
1993	80	7	0	5	9	0	44
1994	74	8	0	4	14	0	50
1995	85	0	0	7	5	2	55

Table 6 Unit 19 brown bear harvest percentage by transport method, 1989–1995

Regulatory year	Percent of harvest									*n*
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Walk	Unk	
1989	82	3	6	0	0	6	0	0	3	34
1990	100	0	0	0	0	0	0	0	0	38
1991	82	0	3	0	0	0	3	0	12	33
1992	83	2	10	2	0	0	0	2	2	58
1993	86	5	2	0	0	2	0	5	0	44
1994	90	4	0	0	4	0	0	2	0	50
1995	98	0	0	0	0	0	0	0	2	55

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. The department 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) 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 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 study area at lower densities that lead to low harvests.

Ballard et al. (1981) and Gasaway et al. (1992) identified grizzly bears as significant predators of moose for 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 likely 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 total population (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.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

Within 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 not subjected to hunting and that is largely unaffected by human activity.

MANAGEMENT OBJECTIVES

Unit 20A Mountains

- Decrease human-caused grizzly bear mortality until at least 1997 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 to:
    - 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 20B, remainder of 20C, 20F, and 25C

- Manage human-caused mortality to provide stable grizzly bear populations with a 3-year mean annual human-caused mortality of up to 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 kill date and location, 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 from bears killed in this study area according to Uniform Coding Units (UCUs). 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. 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 feet. 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 is permitted.

The total area within each stratum excluded approximately 1300 km^2 area of glaciers and land above 6000 feet from the high-density stratum and 1000 km^2 from the super stratum. Extrapolations of the following densities resulted in estimates of population size: low, 1–3 bears/1000 km^2; medium, 5–10 bears/1000 km^2; high, 14–17 bears/1000 km^2; and super, 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. By the end of this reporting period, female adult bear numbers had approached pre-reduction levels (Reynolds 1996). If further data confirm this trend, we will address restoring the original fall seasons during the next cycle of the Board of Game.

The Unit 20A Tanana Flats 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 2.5 bears/1000 km^2.

Unit 20C. Eagan (1995) classified the mountainous portion of Unit 20C into the super stratum (20–30 grizzly bears/1000 km^2). Although Dean (1987) estimated 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) considered the remainder of Unit 20C to be low but suggested the potential for slightly higher densities than other low areas because the Unit 20C flats have salmon streams and relatively low hunting pressure.

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 were rated medium density because of the better habitat and relative inaccessibility.

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 rated 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 through the area allow good access. While hunting caribou and moose, hunters incidentally take grizzly bears.

Population Size

Extrapolating from this stratification, Eagan (1995) estimated that 446 to 782 grizzly bears (all ages) inhabit the study area. Using the midpoint of the population estimate (614 bears), the combined subunit density is about 6.2 grizzly bears/1000 km^2.

Population Composition

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

Distribution and Movements

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

MORTALITY

Harvest

Season and Bag Limit. In regulatory years 1990 through 1993, 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, in 1994 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.

Harvest by Hunters. Recent harvest in Units 20A, 20B, 20C, 20F, and 25C seems relatively stable (Table 1). Hunters killed 25 bears in all units during 1994 and 19 during 1995. Vehicle collisions and DLP kills resulted in 3 bear deaths in 1994.

Harvest Zones. Human-caused mortality of grizzly bears in Unit 20A mountains totaled 9 and 11 bears during the 1994 and 1995 calendar years, respectively (Table 2). This represents a 3-year average annual harvest rate of approximately 10% of bears ≥ 2 years old. This calculation stems from Eagan's (1995) population estimates and Reynolds' (1993) age structure. Human-caused mortality totaled 4 females <6 years old in 1994 and 2 females <6 and 2 females ≥6 years old in 1995.

Eastern half of Unit 20B — The 3-year mean annual mortality of 3 bears ≥2 years of age met our objective for up to 6 bears/year (Table 2). For 1994 and 1995 combined, females composed 44% of the harvest.

Unit 20A Flats, western half of 20B, 20C, 20F, and 25C combined — Humans killed 21 and 6 bears in this area during the 1994 and 1995 calendar years, respectively, including 18 males and 9 females all ≥2 years old. The 3-year mean harvest of 11 bears per year was only 42% of

our objective for up to 26 bears. In addition, the mortality included 67% (n = 29) males, which easily met our objective for at least 55% males.

Harvest continued to meet most subunit objectives as well, with a mean harvest of 2 from the western half of Unit 20B, 4 from Unit 20C, 1 from Unit 20F, and 0.5 from Unit 25C for 1994 and 1995. The take from the Tanana Flats in Unit 20A averaged 5 bears for 1994 and 1995, exceeding objectives. Illegal harvest of 5 bears from a single location resulted in a total take of 7 bears from the flats in 1994. Harvest on the flats returned to more usual numbers in 1995 when total harvest equaled 3.

Hunter Residency and Success. As in previous years, Alaska residents harvested most (67%) of the grizzly bears killed by humans in the study area during the last 3 regulatory years (Table 3).

Harvest Chronology. Similar to previous years, 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 (Table 5).

CONCLUSIONS AND RECOMMENDATIONS

We exceeded management objectives for Unit 20A mountains even with the shortened season. However, the population may recover to pre-reduction levels by 1997 with harvests exceeding objectives (Reynolds 1996). Since the recovery phase is complete, we may initiate a proposal in 1998 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 result in a decrease in bear numbers. 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, as we encourage the harvest of males over females. Through the next board meeting in March 1998, 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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Table 1a Unit 20A human-caused mortality[a] of grizzly bears 1991-1992 through 1995-1996 regulatory years

Regulatory year	Reported											
	Hunter kill[b]				Nonhunting kill[c]			Total estimated kill[d]				
	M	F	Unk	Total	M	F	Unk	M	F	Unk	Total	% Males
1991-1992												
Fall 1991	5	6	1	12	0	0	0	5	6	1	12	
Spring 1992	2	0	0	2	0	0	0	2	0	0	2	
Total	7	6	1	14	0	0	0	7	6	1	14	50
1992-1993												
Fall 1992	10	10	0	20	0	1	0	10	11	0	21	
Spring 1993	1	4	0	5	0	0	0	1	4	0	5	
Total	11	14	0	25	0	1	0	11	15	0	26	58
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

[a] Data from 21 November 1994 harvest printout.

[b] Includes illegal kills.

[c] 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.

[d] Percentage includes only bears of known sex.

Table 1b Unit 20B human-caused mortality[a] of grizzly bears 1991-1992 through 1995-1996 regulatory years

Regulatory year	Reported											
	Hunter kill[b]				Nonhunting kill[c]			Total estimated kill[d]				
	M	F	Unk	Total	M	F	Unk	M	F	Unk	Total	% Males
1991-1992												
Fall 1991	2	3	0	5	1	0	0	3	3	0	6	
Spring 1992	1	2	0	3	0	0	0	1	2	0	3	
Total	3	5	0	8	1	0	0	4	5	0	9	44
1992-1993												
Fall 1992	6	3	0	9	1	0	0	7	3	0	10	
Spring 1993	2	0	0	2	0	0	0	2	0	0	2	
Total	8	3	0	11	1	0	0	9	3	0	12	75
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	
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

[a] Data from 21 November 1994 harvest printout.

[b] Includes illegal kills.

[c] 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.

[d] Percentage includes only bears of known sex.

Table 1c Unit 20C human-caused mortality[a] of grizzly bears 1991-1992 through 1995-1996 regulatory years

Regulatory year	Reported											
	Hunter kill[b]				Nonhunting kill[c]			Total estimated kill[d]				
	M	F	Unk	Total	M	F	Unk	M	F	Unk	Total	% Males
1991-1992												
Fall 1991	3	2	0	5	0	0	0	3	2	0	5	
Spring 1992	1	0	0	1	0	0	0	1	0	0	1	
Total	4	2	0	6	0	0	0	4	2	0	6	
1992-1993												
Fall 1992	3	0	0	3	0	0	0	3	0	0	3	
Spring 1993	1	0	0	1	0	0	0	1	0	0	1	
Total	4	0	0	4	0	0	0	4	0	0	4	
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	
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	

[a] Data from 21 November 1994 harvest printout.

[b] Includes illegal kills.

[c] 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.

[d] Percentage includes only bears of known sex.

Table 1d Unit 20F human-caused mortality[a] of grizzly bears 1991-1992 through 1995-1996 regulatory years

Regulatory year	Reported											
	Hunter kill[b]				Nonhunting kill[c]			Total estimated kill[d]				
	M	F	Unk	Total	M	F	Unk	M	F	Unk	Total	% Males
1991-1992												
Fall 1991	1	0	0	1	0	0	0	1	0	0	1	
Spring 1992	0	0	0	0	0	0	0	0	0	0	0	
Total	1	0	0	1	0	0	0	1	0	0	1	
1992-1993												
Fall 1992	1	0	0	1	0	0	0	1	0	0	1	
Spring 1993	1	0	0	1	0	0	0	1	0	0	1	
Total	2	0	0	2	0	0	0	2	0	0	2	
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	
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	
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	

[a] Data from 21 November 1994 harvest printout.

[b] Includes illegal kills.

[c] 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.

[d] Percentage includes only bears of known sex.

Table 1e Unit 25C human-caused mortality[a] of grizzly bears 1991-1992 through 1995-1996 regulatory years

Regulatory year	Reported											
	Hunter kill[b]				Nonhunting kill[c]			Total estimated kill[d]				
	M	F	Unk	Total	M	F	Unk	M	F	Unk	Total	% Males
1991-1992[e]												
Fall 1991	0	0	0	0	0	0	0	0	0	0	0	
Spring 1992	0	0	0	0	0	0	0	0	0	0	0	
Total	0	0	0	0	0	0	0	0	0	0	0	
1992-1993[e]												
Fall 1992	0	0	0	0	0	0	0	0	0	0	0	
Spring 1993	0	0	0	0	0	0	0	0	0	0	0	
Total	0	0	0	0	0	0	0	0	0	0	0	
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	
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

[a] Data from 21 November 1994 harvest printout.

[b] Includes illegal kills.

[c] 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.

[d] Percentage includes only bears of known sex.

[e] No mortality reported.

Table 2 Human-caused mortality of grizzly bears in 3 harvest zones within Units 20A, 20B, 20C, 20F, and 25C, calendar year 1991 through 1995

Harvest zone	Area (km^2)	Calendar year	No. bears killed		3-year mean harvest[a]		Harvest density[a]
			All ages[b]	≥ 2 years[c]	All ages	≥ 2 years[c]	
20A mountains	7980[d]	1991	12	11			
		1992	21 (1)	20			
		1993	14	14			
		1994	9	9			
		1995	11 (1)	11	11.3	11.3	1.4
Eastern half of 20B	12,766	1991	4	4			
		1992	9 (1)	9			
		1993	2 (1)	2			
		1994	2	2			
		1995	7	5	3.7	3.0	0.2
Combined 20A Flats, Western half of 20B, 20C, 20F, 25C	68,060[e]	1991	14 (2)	14			
		1992	9 (2)	9			
		1993	6	6			
		1994	21 (7)	21			
		1995	6	6	11.0	1.0	0.2

[a] Bears ≥ 2 years old harvested per 1000 km^2.

[b] Parentheses indicate how many of these bears were killed by other than hunter harvest (i.e., defense of life and property, illegal kills, research activities).

[c] Assuming all bears of unknown age were ≥ 2 years old.

[d] Excludes about 1300 km^2 of nonbear habitat in glaciers and above 6000 ft.

[e] Excludes 11,500 km^2 that is closed to hunting in Denali National Park.

Table 3 Residency of successful grizzly bear hunters, 1991-1992 through 1995-1996, combined Units 20A, 20B, 20C, 20F, and 25C

Regulatory	Alaska residents		Nonresident		Unknown		
year	No.	%	No.	%	No.	%	*n*
1991-1992	24[a]	80	6	20	0		30
1992-1993	26[b]	59	12[c]	27	6	14	44
1993-1994	18[d]	69	8	31	0		26
1994–1995	19	69	4	14	5[e]	18	28
1995–1996	12	63	6	32	1	5	19
3-year total	49	67	18	25	6	8	73

[a] Includes 2 illegal kills and 1 defense of life or property (DLP).

[b] Includes 1 illegal kill and 2 DLP.

[c] Includes 2 DLP.

[d] Includes 5 illegal kills.

[e] Includes 1 DLP and 2 vehicle collisions.

Table 4 Percentage of grizzly bear harvest[a] taken by time period, 1991-1992 through 1995-1996, combined Units 20A, 20B, 20C, 20F, and 25C

	Percentage of harvest[a]								
Regulatory	Sep					May			
year	1-15	16-30	Total	Oct	Apr	1-15	16-31	Total	*n*
1991–1992	59	22	81	0	7	4	7	11	27
1992–1993	44	28	72	8	5	10	5	15	39
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
3-year total	38	28	66	3	2	10	21	30	22

[a] Excludes bears killed in DLP or illegally.

Table 5 Percentage of grizzly bear harvest[a] taken by transport method, 1991-1992 through 1995-1996, combined Units 20A, 20B, 20C, 20F, and 25C

Regulatory year	Percent of harvest[a]						
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highwa vehicle
1991-1992	37	7	15	0	4	0	26
1992-1993	41	5	5	15	0	0	18
1993-1994	19	29	19	10	0	5	19
1994–1995	8	12	16	20	0	4	24
1995–1996	21	26	21	21	0	5	5
3-Year total	16	22	19	17	0	5	16

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

LOCATION

GAME MANAGEMENT UNIT: 20D (5720 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 less available in northern Unit 20D.

MANAGEMENT DIRECTION

During this reporting period, the Alaska Board of Game adopted an annual harvest goal of 5 to 15 brown bears for Unit 20D. The harvest objective established by the department is for a minimum of 60% of harvested bears to be males. No population size goal was adopted.

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, date and location of kill, number of days hunted, and hunter name and address. A premolar tooth was extracted from each bear skull for age determination.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Brown bear population estimates were calculated for Unit 20D in May 1993. The Unit 20D estimate was 181 to 210 total bears, with 143 to 176 bears ≥ 2 years old. The population estimate was derived by calculating separate estimates for Unit 20D north and south of the Tanana River as described below.

Reynolds (pers commun) plans to refine Alaska Range brown bear density estimates upon which the southern Unit 20D population estimate is based. He also plans to complete a population model that calculates sustainable harvest levels based on harvest of females, rather than the current model which 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.

Southern Unit 20D. The southern Unit 20D population estimate was 51 to 58 bears ≥ 2 years old and 76 to 86 total bears. This estimate was based on density estimates of 9.8 to 11.2 bears ≥ 2 years old/1000 km^2, plus 14% cubs and yearlings, developed by Reynolds (pers commun) for similar habitat in the Alaska Range in Unit 20A.

Northern Unit 20D. The northern Unit 20D population estimate is 92 to 109 brown bears ≥ 2 years old and 105–124 brown bears. This estimate was based on Gasaway's (1990) brown bear density estimates for Unit 20E of 10.4 to 12.4 bears ≥ 2 years old/1000 km^2, plus 14% additional cubs and yearlings.

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. The following seasons and bag limits were in effect during this reporting period:

1994–1995 — North of the Tanana River season dates were 10 August–30 June. The bag limit was 1 bear every regulatory year. A $25 tag was required for resident hunters. Hunters taking bears in this area were required to have the bears sealed in Unit 20D or in Tok.

South of the Tanana River season dates were 1 September–31 May. The bag limit was 1 bear every 4 regulatory years. A $25 tag was required for resident hunters.

1995–1996 and 1996–1997 — Season dates for 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, were 10 August–30 June. The bag limit was 1 bear every 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 was 1 September–31 May. The bag limit was 1 bear every 4 regulatory years. A $25 tag was required of resident hunters.

Board of Game Actions and Emergency Orders. In December 1994 the Alaska Board of Game determined that Unit 20D is appropriate for intensive management of predators and prey, including brown bears, as enacted by Senate Bill 77. As a result, the board extended the brown bear hunting season in southern Unit 20D east of the Gerstle River to 10 August–30 June, reduced the bag limit to 1 bear every year, and eliminated the $25 resident tag fee for hunting

brown bears north of the Tanana River or east of the Gerstle River. The board also adopted harvest goals of 5 to 15 brown bears per year in Unit 20D.

Hunter Harvest.

1994–1995 — Hunters killed 6 bears during the 1994–1995 hunting season (Table 1) and met the harvest goal. However, harvest consisted of 50% males and exceeded the objective for females in the harvest. Four bears, 2 males, and 2 females were taken in fall 1994. Two bears, 1 male, and 1 female, were taken in spring 1995.

Unit harvest during 1994–1995 did not vary significantly from the mean harvest of 6.4 bears/year (r = 4-9) during the previous 5 years. All 6 bears killed were taken south of the Tanana River, and no bears were taken north of the Tanana River, despite the longer season and more liberal bag limit in effect there (Table 2).

1995–1996 — Hunters killed 16 bears during the 1995–1996 hunting season (Table 1) and exceeded the maximum harvest goal by 1 bear. Harvest consisted of 68.8% males and met the male harvest objective. The increased harvest occurred in northern Unit 20D and in southern Unit 20D, west of the Gerstle River. Eleven bears, 8 males, and 3 females were taken during the fall 1995 portion of the season. Five bears, 3 males, and 2 females were taken during the spring 1996 portion of the season.

Seven bears were killed in northern Unit 20D, which is a significant increase from the mean harvest of 1.2 bears/year (r = 0–3) for the previous 5 years (Table 2). Hunters killed bears over a wide portion of northern Unit 20D. One concern with the liberalized season and bag limit in northern Unit 20D is that some hunters may try to "bootleg" bears killed outside of Unit 20D, by claiming they were killed in portions of Unit 20D to take advantage of the 1 bear/regulatory year bag limit. During the 1995-1996 season, there was 1 bear sealed from northern Unit 20D that we suspect was bootlegged.

Harvest also increased in southern Unit 20D west of the Gerstle River, where 7 bears were reported killed. This is a significant increase from the mean harvest of 3.0 bears killed/year (r = 3) during the previous 5 years. Because this portion of southern Unit 20D has the more restrictive season and bag limit, none of these bears was probably bootlegged.

Only 2 bears were reported taken in Unit 20D east of the Gerstle River. Seasons and bag limits were liberalized in this area to encourage hunters to take bears within the calving grounds of the Macomb Caribou Herd. An attempt was also made to attract bear hunters to this area by informing hunters of liberal seasons and good bear hunting opportunity. However, these efforts did not result in an increase in bear harvest in the area.

1996–1997 — Hunters killed 6 bears during the fall portion of the 1996–97 hunting season. Harvest consisted of 66.7% males and met the harvest objective for male bears during this portion of the season (Table 1). Four bears were taken in southern Unit 20D, and 2 were taken in northern Unit 20D (Table 2).

Hunter Residency and Success. No significant changes occurred in residency of Unit 20D brown bear hunters; residents killed most brown bears. During the 1994–95 through fall 1996–97 hunting seasons, 46.4% of bears were killed by local residents, 42.9% were killed by nonlocal residents, and 1 bear, representing 3.6% of the harvest, was killed by a nonresident (Table 3). Hunters killed 2 bears with unknown residency.

Harvest Chronology. No significant change occurred in harvest chronology during this report period. In Unit 20D most brown bears were taken during the fall hunting season. During the 1994–95 through fall 1996 hunting seasons, 75.0% of the bears were killed during August–October of the fall season (Table 4).

Transport Methods. Most transportation types, except snowmachines, are used to take bears in Unit 20D. Highway vehicles, 3- or 4-wheelers, boats, airplanes, and foot access continue to be commonly used transportation types (Table 5).

Other Mortality

One male bear was taken in spring 1995 in a wolf snare. In fall 1996 1 female bear was shot illegally at the Delta landfill, and 1 female was shot in defense of life and property.

CONCLUSIONS AND RECOMMENDATIONS

The Alaska Board of Game liberalized the brown bear hunting season, bag limit, and tag fee requirements in portions of Unit 20D as part of an intensive management program for the area. Subsequently, the harvest of brown bears increased in northern Unit 20D but also increased in Unit 20D west of the Gerstle River without liberalized regulations. Harvest did not increase significantly south of the Tanana River and east of the Gerstle River where regulations were also liberalized.

The harvest goal was met in 1994–1995, but exceeded the goal by 1 bear in 1995–96 (however, 1 bear may have been sealed illegally in the area). Total harvest from 1994–95 through fall 1996 met the male harvest objective with male bears composing 64.3% of the harvest.

The increased harvest in Unit 20D west of the Gerstle River may result in a localized reduction in the brown bear population in this area. However, the localized decline in the bear population may benefit the moose and caribou populations. 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 populations.

The Unit 20D brown bear population should be monitored closely during the next few years to determine the long-term effects of liberalized hunting regulations in portions of the unit; however, with harvest consisting of at least 60% males, no regulatory changes are recommended at this time.

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Table 1 Unit 20D grizzly bear harvest[a], fall 1989 through fall 1996

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													
Fall 1996[b]	4	2	0	6	0	2	0	1	0	4	4	1	9

[a] Includes defense of life or property kills, research mortalities, and other known human-caused accidental mortality.
[b] Preliminary harvest from 1 Jul 1996 to 31 Dec 1996.

Table 2 Annual reported harvest of male and female grizzly bears, north and south of the Tanana River in Unit 20D, 1989 through fall 1996

Regulatory	South of Tanana				North of Tanana				Unk		
year	M	F	Total	%	M	F	Total	%	M	F	Total
1989-1990	2	0	2	50	2	0	2	50	0	0	4
1990-1991	3	4	7	100	0	0	0	0	0	0	7
1991-1992	2	3	5	100	0	0	0	0	0	0	5
1992-1993	4	3	7	70	3	0	3	30	0	0	10
1993-1994	4	1	5	71	1	1	2	29	0	0	7
1994-1995	3	3	6	100	0	0	0	0	0	0	6
1995-1996	7	2	9	56	4	3	7	44	0	0	16
1996-1997[a]	3	1	4	67	1	1	2	33	0	0	6

[a] Preliminary harvest from 1 Jul to 31 Dec 1996.

Table 3 Unit 20D residency of successful grizzly bear hunters, 1989–1996

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[b]	4	2	0	0	6

[a] Residents of Unit 20D.

[b] Preliminary harvest from 1 Jul 1996 to 31 Dec 1996.

Table 4 Unit 20D grizzly bear harvest chronology by month, 1989–1990 through fall 1996

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[a]	1	4	1	0	0	0	0	0	6

Table 5 Unit 20D grizzly bear harvest by transport method, 1989–1990 through fall 1996

Regulatory year	Percent of harvest									
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Foot	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[a]	0	0	33	17	0	0	50	0	0	6

[a] Harvest from 1 Jul 1996 to 31 Dec 1996.

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 and the population recovered. During the early 1980s, grizzly bear hunting regulations were liberalized, resulting in increased harvest. By the mid-1980s the Unit 20E grizzly bear population was estimated to be 12 to 16 bears/1000 km^2 (Boertje et al. 1987).

During the early 1980s moose densities in Unit 20E were low (0.2 moose/mi^2) and grizzly bears were found to be a major factor in limiting this population (Gasaway et al. 1992). Our objective in liberalizing the grizzly bear hunting regulations was to reduce the grizzly population through increased harvest to a level that caused a substantial decline in bear predation on calf moose. Regulation changes included lengthening the season, increasing the bag limit from 1 bear every 4 years to 1 bear per year, and, between 1984 and 1992, revoking the $25 resident tag fee requirement. Grizzly bear harvests increased from a mean harvest of 3 bears/year during 1966–81 to an annual mean of 18 bears/year during 1981–88. Based on the combination of harvest rate, harvest sex ratio, skull size, and average age of the harvested bears, harvest caused a reduction in the grizzly bear population in a portion of Unit 20E.

Survival of moose calves to 5 months of age in Unit 20E increased between 1982 and 1990 during liberalized bear seasons. This increased calf survival was probably related to a reduced number of predators per prey animal as 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 been no field studies designed to evaluate the effects of bear population reductions on moose and caribou calf survival.

MANAGEMENT DIRECTION

MANAGEMENT GOAL

- The management goal is to 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 or reverse bear population declines.

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 management goals and objectives for the area's moose population and for the Fortymile Caribou Herd are for higher populations. Both these prey populations are currently limited by predation and grizzly bears are an important predator on newborn caribou and moose calves. For this reason, since 1991 we have been conducting a management experiment to evaluate the effectiveness of reducing grizzly bear populations in order to increase caribou and 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, Mont) for aging.

I evaluated the trend of the Unit 20E bear populations in the treatment area by comparing the kill density (number of bears harvested/1000 mi^2) (Miller 1990) for the 1977 to 1981 period to that for 1982 to 1995 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.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The Unit 20E grizzly bear population estimate is based on radiotelemetry data collected by Boertje et al. (1987) and harvest statistics. I estimated the fall population to be between 440 and 500 bears (15.9–18.1 bears of all ages/1000 km^2) and the population trend to be stable. Hunters reduced grizzly bear numbers in a portion of Unit 20E during the 1980s due to a liberalization of hunting regulations and a public awareness campaign. During this period annual harvests were below sustainable (5%) for the subunit, but within the Dennison, Middle, West, and Mosquito Forks of the Fortymile River and in the upper Charley River drainages (3670 mi^2), annual harvests ranged between 6% and 11% of the local population. This area will be referred to as the treated area. Grizzly bear numbers in the treated area were estimated to have declined by 38% (Gardner 1995) between 1982 and 1986 and probably continued to decline until 1994 due to high harvest rates (average kill density of 3.2 bears/1000 mi^2). In the remainder of Unit 20E (about 7000 mi^2), harvest remained low (0.17/1000 mi^2) and had little effect on population trend. Since

1993 harvest has been more evenly distributed with less impact on local populations; this allowed the subunit population to stabilize.

Taken independently, specific harvest statistics indicate little change in the subunit's bear population during the period of increased harvest. Average age and skull size of harvested males showed a slight decreasing trend but were not significant ($P = 0.417$ and $P = 0.678$). Average age and skull of harvested females also showed declining trends but were not significant ($P = 0.310$, $P = 0.193$). The trend of percentage of males in the harvest increased slightly but was not significant ($P = 0.917$). Following the approach suggested by Fraser et al. (1982), I looked at the relationship of percent males in harvest to age class between 1982 and 1993. The slope of the line indicated the bear population in the treatment area was heavily harvested which concurs with the kill rate data.

MORTALITY

Harvest

Season and Bag Limit.

Unit 20E	10 Aug–30 Jun	1 bear

A bear taken in this unit does not count against the bag limit of 1 bear every 4 years in other units; however, no person may take more than 1 bear, statewide, per regulatory year. A $25 resident tag fee is 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. In spring 1996 the grizzly bear tag fee was waived in northern Unit 20D to increase harvest that could affect the grizzly bear population in adjacent portions of Unit 20E.

Hunter Harvest. During the 1995–1996 regulatory year, hunters reported taking 21 grizzly bears (11 males and 10 females), exceeding the 5-year average of 16 bears (Table 1). Grizzly bear harvests significantly increased in 1982–83 ($P = 0.001$) compared to harvest totals during 1977–81 and remained high until 1988–1989 (average annual harvest = 18.9) in response to the more liberal seasons and bag limits. Harvests declined between 1989 and 1992 (average harvest = 12.0) even though hunting regulations remained liberal and hunting pressure increased, indicating a reduced number of legal bears in the more accessible areas of Unit 20E. The higher harvest beginning in 1993 can be explained by greater hunter effort in areas that in the past have received little hunting pressure and supported a higher density of bears. In 1995–96 males represented 52% of the harvest. 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 1995–1996 season resident hunters took 43% of the grizzly bear harvest from Unit 20E, compared to the 5-year average of 79% (Table 2). Historically, little guided hunting for grizzly bears occurred in Unit 20E. The few bears taken by nonresidents were killed while hunters (with a first-degree kindred relative who was a state

resident) sought moose or caribou. 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 5 years, most grizzly bears were harvested incidentally during August and September (70%) when most moose and caribou hunters were afield (Table 3). Most bears taken in spring were taken in May and June.

Transport Methods. During 1995–1996 airplanes were used by 57% of successful grizzly bear hunters in Unit 20E (Table 4). During the previous 5 years, most successful bear hunters used airplanes (37%), highway vehicles (18%), and 3- or 4-wheelers (16%) for transportation. 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 DLP incidents during this report period. Possible reasons for the lack of reported DLP kills in recent years is that bear season is only closed from 1 July though 9 August and that bears have been significantly reduced in the accessible areas of the unit. Most natural grizzly bear mortality in this area is probably the result of intraspecific strife and cannibalism as discussed by Boertje et al. (1987).

HABITAT

Assessment

All of Unit 20E is suitable grizzly bear habitat. Few human developments are in this area except 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 important to grizzly bears in other areas. The abnormally high level of wildfire suppression during the 1960s and 1970s has also affected habitat diversity. Grizzly bear habitat use is continuous in the subunit, and average home range sizes for adult male and female bears are 544 mi^2 (s = 268.2) and 151 mi^2 (s = 122.9), respectively.

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 other species from which bears derive benefits as scavengers and predators.

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). A grizzly bear translocation study indicated that reducing a grizzly bear population by 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). Grizzly bear harvest regulations were liberalized in Unit 20E in 1981 to cause a decrease in the bear population to benefit moose. Initial analyses demonstrated that survival of neonatal moose increased substantially after bear reductions (Boertje et al. 1995). Based on the results in Unit 20E, increased hunter harvest of grizzly bears became an acceptable management technique to cause a reduction in the bear population to increase moose calf survival.

Currently within the state there are 3 areas (Units 13, 20D, and 20E) that have grizzly bear management objectives designed to reduce the bear population by 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, we still do not know what level of bear reduction is necessary in relation to ungulate density, wolf density, and other environmental factors to promote greater calf survival. Furthermore, we do not know if we can even obtain that level of harvest.

I reanalyzed the data from Unit 20E by comparing calf survival in an area adjacent to the treatment area that received little bear harvest and presumably had a more natural density of bears 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 discussed several reasons why the reduction in bears did not increase moose calf survival. Subsequent predator–prey analysis indicates that wolf predation 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 reduction of wolf populations.

In the last 2 grizzly bear reports, I recommended that a research program be initiated to answer questions of how and when increased grizzly bear harvest could enhance moose or caribou calf survival. This research would be useful to answer management concerns, but funding is not presently available to conduct such research. However, the division should be able to provide an informed response when we receive requests for additional high bear harvest areas to increase calf survival. On one hand, the public is convinced that reducing bears through harvest will always result in greater calf survival; in contrast, there is a growing segment of the public who looks very critically at any program designed to reduce predators. Both look to the division to recommend the responsible action. Yet, we only have equivocal data with which to work. Unless the division conducts research to address this issue, public sentiment may lead to passage of bear regulations not based on biological principles and, therefore, ineffectual in improving sustainable harvest of moose. Another outcome could be the unnecessary reduction of bear populations. We should implement a harvest program that includes time-specific conditions that delineate at what point the program will be limited if there is no improvement in calf survival or the desired harvest has been reached.

A different bear harvest strategy for both Units 20E and 12 should be designed to allow for maximum grizzly bear hunting opportunity and, if desired, result in local population declines but still offer adequate protection to the bear population. Harvest components that should be included are a 1 bear per year bag limit, a bear tag that can be purchased after the bear is harvested, more restrictive sealing requirements, and a quota on the number of females in the harvest. This

approach would require estimates of the number of harvestable females, determining whether the harvest and female quotas should be based on a running average over multiple years and whether the unit or subunit can be further divided to ensure the protection of isolated areas. Answers to these questions should be based on research of sustainable yield of grizzly bears in Unit 20A. I would like to present this idea to the advisory committees and to the Board of Game in spring 1998.

CONCLUSIONS AND RECOMMENDATIONS

The current Unit 20E grizzly bear population estimate is 440–500 bears, and population trend is stable. Harvest data indicates the Unit 20E grizzly bear population has declined only slightly since 1981 even though very liberal hunting regulations have prevailed. 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 between 1981 and 1994. Annual kill densities ranged from 1.92 to 4.35 bears/1000 mi^2 and caused an estimated 38% population decline in this central portion of the subunit. Since 1994, harvest has become more dispersed across the subunit and within sustainable limits (2–5%).

Grizzly bear management in Unit 20E has been successful in providing for maximum bear hunting opportunity. However, we do not know if we are meeting our other management objective of causing increased moose or caribou calf survival by reducing the grizzly bear population using liberalized harvest regulations. Calf survival was comparable between an area where hunters had reduced the grizzly population and 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 enhanced calf survival in the treatment area, I recommend the current management objectives be retained. During the past 2 years, trappers have reduced the wolf population in a portion of the subunit; and wolves may be further reduced if the Fortymile Caribou Management Plan is implemented in winter 1997–1998. Research and management efforts in conjunction with the plan will benefit from documenting effects of greater bear harvest in this 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 2000 and, hopefully, will 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 high levels of hunter opportunity while providing adequate protection of the grizzly bear population.

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Table 1 Unit 20E grizzly bear harvest, 1989–1996

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[b]															
Fall 1996	8	9	0	17	0	0	0	0	0	8	(47)	9	(53)	0	17

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

[b] Preliminary harvest.

Table 2 Unit 20E residency of successful grizzly bear hunters, 1989–1996

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[a]	15	(88)	2	(12)	0	(0)	17

[a] Preliminary harvest.

Table 3 Unit 20E brown bear harvest chronology by time period, 1989–1996

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[a]	6	(35)	11	(65)	0	(0)									17
Average %		(23)		(47)		(4)		(0)		(3)		(12)		(11)	

[a] Preliminary harvest.

Table 4 Unit 20E grizzly bear harvest percentage by transport method, 1989–1996

Regulatory year	Method of Transportation									
	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[a]	47	6	0	12	0	6	12	18	0	17

[a] Preliminary harvest.

LOCATION

GAME MANAGEMENT UNIT: 21 (35,000 mi^2)

GEOGRAPHIC DESCRIPTION: Middle Yukon River, including lower Koyukuk River, Innoko River, Nowitna River and Melozitna River

BACKGROUND

Grizzly bears are in low to moderate numbers throughout the area, with highest numbers in the more mountainous areas. Populations have been stable or slowly increasing with low annual reported harvests of usually less than 10 bears per year.

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

- 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. The nuisance bear problem will be addressed through education, legal harvest of problem bears, and changes in regulations.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The population is believed to have been stable or slowly increasing during the past 10 years based on field observations, nuisance reports, and hunter sightings. No surveys have been conducted in the area; however, population estimates have been made based on known bear densities in similar habitats in other Interior units. Using a figure of 25 bears/1000 mi^2 in the best bear habitat and 10 bears/1000 mi^2 in the rest of the area, I estimate the population at 500 to 600 bears. The Nulato Hills area of Units 21D and 21E have the best bear habitats followed by all of Unit 21C.

MORTALITY

Harvest

Hunting pressure on bears in the unit is low (Table 1), although the season has been liberalized from 47 days in 1981 to 129 in 1982–1983, 139 in 1984–1986, 180 from 1987 to 1990, and to 273 days since 1991. Considering the estimated populations, I estimate sustainable harvest between 25 and 30 bears. The number of bears that were taken at fish camps and not reported is unknown but is estimated at a maximum of 10 bears per year.

Seasons and Bag Limits.

Units and Bag Limits	Resident Open Season	Nonresident Open Season
Unit 21D One bear every regulatory year by registration permit.	1 Sep–31 May (Subsistence hunt only)	No open season
Unit 21D 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 that meat from bears taken under the subsistence registration permit is salvaged for human consumption and the hide and skull need not be sealed unless they are removed from the management area. If the hide was removed from the Northwest Alaska Brown Bear Management Area, then the Alaska Department of Fish and Game would take the skin of the head and front claws.

Hunter Residency and Success. There is no set pattern of harvest among user groups (Table 2) though annually most bears are taken during spring. The new guide area regulations increased opportunities for spring bear hunting. One guide operated in the Nulato Hills with snowmachines and harvest increased in 1993. Snow conditions are not good enough regularly to sustain this type of operation, and I suspect harvest will fluctuate with snow conditions. The harvest by subunit (Table 3) shows that the areas with the most bears produce the greatest harvest.

CONCLUSIONS AND RECOMMENDATIONS

The management objective for grizzly bears in Unit 21 is to allow for a minimum reported harvest of 10 bears annually. At present, the estimated annual reported and unreported harvest is below the estimated sustainable harvest. Until the big game tag fee for grizzly bears in Unit 21 is removed and hunting habits change, the human harvest will have a negligible effect

on grizzly populations in this unit. We must enhance our educational efforts to reduce the present level of unreported harvest.

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Table 1 Unit 21 grizzly bear harvest, 1989–1996

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
1989-1990														
Fall 1989	2	2	0	4	0	0	0	0	5	0	2	2	5	9
Spring 1990	3	3	0	6	0	0	0	0	5	0	3	3	5	11
Total	5	5	0	10	0	0	0	0	10	0	5	5	10	20
1990-1991														
Fall 1990	2	1	0	3	0	0	0	0	5	0	2	1	5	8
Spring 1991	1	4	0	5	0	0	0	0	5	0	1	4	5	10
Total	3	5	0	8	0	0	0	0	10	0	3	5	10	18
1991-1992														
Fall 1991	0	0	0	0	0	0	0	0	5	0	0	0	5	5
Spring 1992	4	2	0	6	1	0	0	1	4	0	5	2	5	12
Total	4	2	0	6	1	0	0	1	9	0	5	2	10	17
1992-1993														
Fall 1992	3	2	0	5	0	0	0	0	5	0	3	2	5	10
Spring 1993	8	3	0	11	0	0	0	0	5	0	8	3	5	16
Total	11	5	0	16	0	0	0	0	10	0	11	5	10	26
1993-1994														
Fall 1993	1	2	0	3	0	0	0	0	5	0	1	2	5	8
Spring 1994	5	0	0	5	0	0	0	0	5	0	5	0	5	10
Total	6	2	0	8	0	0	0	0	10	0	6	2	10	18
1994-1995														
Fall 1994	1	3	0	4	0	0	0	0	5	0	1	3	5	9
Spring 1995	4	1	0	5	1	0	0	1	5	0	5	1	5	11
Total	5	4	0	9	1	0	0	1	10	0	6	4	10	20
1995-1996														
Fall 1995	0	0	0	0	0	0	0	0	5	0	0	0	5	5
Spring 1996	1	2	0	3	0	0	0	0	5	0	1	2	5	8
Total	1	2	0	3	0	0	0	0	10	0	1	2	10	13
1996-1997														
Fall 1996	2	2	0	4	1	0	0	1	5	0	3	2	5	10

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

Table 2 Residency of successful grizzly bear hunters, Unit 21, 1989–1996

Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Total successful hunters
1989-1990	1	3	6	10
1990-1991	3	2	3	8
1991-1992	0	1	6	7
1992-1993	2	2	12	16
1993-1994	2	1	3	6
1994-1995	3	3	3	9
1995-1996	1		2	3
Fall 1996	0	2	2	4

[a] Unit residents.

Table 3 Unit 21 bear harvest by subunit, 1989–1996

Regulatory year	Subunit				
	21A	21B	21C	21D	21E
1989-1990	3	0	1	3	3
1990-1991	2	0	1	1	3
1991-1992	0	0	0	3	5
1992-1993	2	1	0	8	2
1993-1994	0	0	2	4	2
1994-1995	2	0	3	5	0
1995-1996	0	0	0	3	0
Fall 1996	2	0	2	1	0
Total	11	1	9	24	15

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 grizzly 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.

Interest in harvesting bears by recreational hunters, principally from the Nome area, remains high. Reindeer herders report that adverse interactions between reindeer and grizzly bears are increasing. 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

The following management goals and objectives have been established for grizzly bear populations in Unit 22:

1 Maintain grizzly bear populations at existing levels in Unit 22.

- a Assess harvest and collect specimens as needed.
- b Improve compliance with bear harvest reporting requirements.
- c Seal bears and monitor the harvest.

2 Minimize adverse interactions between the public and bears.

3 Develop a grizzly bear management plan.

METHODS

We recorded bear observations 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 nonresident permit harvest reports and sealing certificates.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We believe that grizzly bear numbers are stable or increasing throughout Unit 22. The bear research study and census provided data regarding the population size and status of bears for Unit 22C and portions of Units 22B and 22D during the early 1990s (Miller and Nelson 1993). The density estimate of grizzly bears >2 years old for the 12,509 mi^2 study area was 458 bears (1 bear per 27 mi^2). Densities ranged from a high in the western portion of Unit 22B of 1 bear per 20 mi^2 to a low in the southern portion of Unit 22E of 1 bear per 39 mi^2.

Very little data are available regarding the density of grizzly bears in Unit 22A and the eastern portion of 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 density estimate for Unit 22, these estimates should be regarded with caution.

MORTALITY

Harvest

Season and Bag Limit.

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 22A		
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 22B 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 22C 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 22D 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 22E.		1 Sep–31 Oct 15 Apr–25 May
Unit 22E 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		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 minimal subsistence use of grizzly bears occurs in Unit 22 (Conger *et al.* 1990). The annual harvest during the 2-year reporting period was 43 bears during the 1994–95 regulatory year and 52 bears during the 1995–96 year (Tables 1 and 2). More bears (70%) were 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).

Historical harvest data collected since the sealing requirement was instituted in the early 1960s indicate that more male bears have been harvested than females. The harvest during the current reporting period was no exception. Sex composition of the harvest from fall 1994 through spring 1996 was 66% males and 34% females. This is identical to the composition reported from fall 1992 through spring 1994.

The mean age of bears harvested by hunters has declined during the last 5 years. From fall 1990 through spring 1992, the mean age of harvested males was 7.3 years (n = 61), of females 7.7 years (n = 25), and of both sexes combined 7.4 years (n = 86). From fall 1992 through spring 1994, the mean age of male bears harvested declined to 6.0 years (n = 65), of females 4.8 years (n = 39), and of all bears combined 5.5 years (n = 106). During the 1994 regulatory year from fall 1994 through spring 1995, the mean age of harvested male bears was 5.7 years (n = 28), of female bears 4.6 years (n = 11), and of all bears combined 5.3 years (n = 40). We believe that heavy harvests in accessible areas has removed many of the larger and older male bears, and hunters are now harvesting smaller, younger bears.

Five bears were reported as nonhunting kills taken in defense of life and property (DLP) during the 2-year reporting period (Table 1). However, these totals do not represent the actual number of nonhunting 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 10–30 bears were killed annually and not reported in Unit 22.

Permit Hunts. In 1980 the Board of Game required nonresidents to obtain a drawing permit to hunt in all of Unit 22. The following year, the Alaska Board of Game eliminated the requirement in Unit 22A. During the period 1980–92, 20 drawing permits (10 in the spring and 10 in the fall) were available annually to nonresidents for Units 22B, 22C, 22D, and 22E until the 1992 regulatory year. Since 1992, 20 drawing permits have since been allocated to nonresident hunters in Units 22B and 22C and 5 permits to nonresidents in Units 22D and 22E. Most nonresidents who draw a permit hunt with registered guides.

Hunter Residency and Success. Nonresident hunter success rates are high unitwide. In Unit 22A where nonresident hunting opportunity has not been restricted by drawing permit quotas, the size of the nonresident harvest surpasses that of residents. Because nonresident effort throughout the remainder of the unit is 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.

We cannot easily evaluate hunter effort and success under the present harvest reporting system. With the exception of nonresident permittees, 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 aid snowmobile travel and tracking.

Harvest Chronology. The spring bear harvest typically exceeds the fall harvest, and the harvest pattern during the past 2 years was no exception (Table 2). Many local hunters prefer to hunt bears in the spring when snow cover is present because of easier access for snowmobiles and because bears are easier to locate and track. During the fall, access is more limited, bears are 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 many bear hunters to reach suitable habitat that might otherwise be inaccessible. Although the data suggest that harvests occurring along the road corridors are low (Table 4), hunters frequently use these roads as access points for boats, ORVs, and snowmobiles. 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.

CONCLUSIONS AND RECOMMENDATIONS

Interest in grizzly bears by hunters and others on the Seward Peninsula continues to increase. Many reindeer herders, campers and miners would like to see bear numbers reduced. Other local residents strongly believe that increasing bear numbers are a major cause of moose mortality. The grizzly bear research project addressing productivity and population density indicated that harvest levels in the heavily hunted, accessible areas near Nome are probably at or near sustained yield. Results of the study should continue to assist the department in addressing these and other concerns.

Harvest reporting in Unit 22 falls into 2 categories: 1) sealing of bears taken during established hunting seasons; and 2) reporting of bears killed in DLP. 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 very low. Some rural residents continue to kill bears without reporting these activities. Many individuals consider bears nuisances and do not believe it worth their time or effort to skin a bear and/or report the incident, especially if they are required by law to surrender the hide and skull to the department. Consideration should be given to changing current statewide regulations regarding bears taken in DLP to improve compliance.

Until the size of the local harvest is better documented and current regulations are accepted by the public with a greater degree of satisfaction, any regulatory change that would substantially increase the harvest of grizzly bears within Unit 22 should not be implemented. However, the proportion of male bears in the harvest is relatively high compared to the proportion of females in the harvest, and we believe that current harvests are probably not excessive. Information reported by knowledgeable local residents and staff indicate that bear numbers are probably

increasing in Units 22A and 22B. Modest harvest increases in these 2 units may be permissible in areas where adverse bear/human interactions are common.

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Table 1 Unit 22 brown bear harvest[a] for regulatory years 1994–1995 and 1995–1996

Regulatory year	Reported Harvest											
	Hunter kill				Non-hunting kill[b]				Total kill			
	M	F	Unk.	Total	M	F	Unk.	Total	M	F	Unk.	Total
1994-95												
Fall 1994	6	5	1	12	1	0	0	1	7	5	1	13
Spring 1995	23	7	0	30	0	0	0	0	23	7	0	30
Total	29	12	1	42	1	0	0	1	30	12	1	43
1995-96												
Fall 1995	5	10	0	15	0	0	0	0	5	10	0	15
Spring 1996	25	8	0	33	2	1	2	5	27	9	2	38
Total	30	18	0	48	2	1	2	5	32	19	2	53

[a] Figures also include permit hunt harvest

[b] Represents the total known harvest

Table 2 Sex of Unit 22 brown bear harvest for regulatory years 1994–1995 and 1995–1996

Regulatory year	Unit									
	22A		22B		22C		22D		22E	
	M	F	M	F	M	F	M	F	M	F
1994-95										
Fall 1994	2	0	0	0	3	3	1	2	0	0
Spring 1995	3	0	13	4	0	0	5	2	2	1
1995-96										
Fall 1995	2	2	3	4	0	2	0	2	0	0
Spring 1996	4	3	14	3	1	0	3	1	3	1

Table 3 Residency of successful brown bear hunters[a] in Unit 22 for regulatory years 1994–1995 and 1995–1996

Regulatory year	Local[b] resident	%	Nonlocal resident	%	Nonresident	%	Total successful hunters
1994	20	48	8	19	14	33	42
1995	17	35	5	11	26	54	48

[a]Figures include successful drawing permit hunters
[b]Hunters residing in Unit 22

Table 4 Unit 22 brown bear harvest by transport method for regulatory years 1994–1995 and 1995–1996

	Harvest							
Regulatory year	Airplane	Boat	Snowmachine	ORV	Highway vehicle	Walk	Unknown	Total *n*
1991	5	1	4	5	0	0	29	44
1992	6	8	28	6	10	1	1	60
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

LOCATION

GAME MANAGEMENT UNIT: 23 (43,000 mi^2)

GEOGRAPHIC DESCRIPTION: Kotzebue Sound and western Brooks Range

BACKGROUND

In 1961 the department established grizzly bear hunting regulations and sealing requirements in Unit 23. The Board of Game created regulations under the assumption that the primary use of grizzly bears was for sport and trophy hunting. However, Inupiat hunters in inland communities of Unit 23 traditionally harvested grizzlies for meat and hides (Loon and Georgette 1989). In response to frustration expressed by the public over hunting regulations for brown bears and other species, in 1988 department staff began an extensive regulation review in Unit 23. 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 grizzly bears in Unit 23 consists of a baseline study of density, movements, and productivity of bears near the Red Dog Mine (Ballard et al. 1991).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

The primary management goal for grizzly bears in Unit 23 is to maintain a minimum density of 1 adult bear per 25.7 mi^2 in the Noatak drainage. Our second goal is to improve the accuracy of harvest information.

MANAGEMENT OBJECTIVES

1 Conduct a census in the Noatak drainage prior to further mining development. The census should be comparable to the census completed in 1987.

2 Develop an alternative technique to assess trends in brown bear abundance that is not dependent on radiocollaring bears. Total cost, impact on animals, statistical validity, and 3- to 5-year repeatability should be considered in the design. Results should be sensitive enough to alert biologists of potential population problems.

3 Develop an alternative harvest reporting system acceptable to rural residents by 1998 to improve the accuracy of harvest data. Explore the possibilities of community harvest assessment. 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 new 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. The population status of bears in Unit 23 is based on information from unit residents and staff observations.

National Park Service (NPS) and the department removed the remaining radio collars from bears in the Noatak and Wulik River drainages. Methods used to capture bears were the same as those described by Ballard et al. (1991). During April and May 1995, the Selawik National Wildlife Refuge (FWS) began a feasibility study to determine if dens could be used to monitor brown and black bear abundance (G. Peltola, pers. commun.).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Hunters and other residents reported grizzly bears in most areas to be abundant and stable at levels reached between 1990–92. 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 1 adult bear (2.5 + years) per 25.7 mi^2 near the Red Dog Mine (Ballard et al. 1991).

Attempts to establish trends in den site densities for brown and black bears in the Selawik drainage have been unsuccessful primarily due to poor snow cover. Refuge staff will prepare a final evaluation of the technique after the 1997 field season. Without recent census data we have no quantitative means to determine population status or trend.

Distribution and Movements

In June 1995 NPS and Department staff removed 20 radio collars from bears near the Red Dog Mine. Telemetry flights from 1990–1995 showed continued fidelity to home ranges and den sites as described in the first study report (Ballard et al. 1991). NPS staff will prepare a summary of the additional telemetry data collected. Three of 20 bears showed indications their collars were too tight. Biologists suspected 2 bears had lice.

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 Residents: One bear per regulatory year by registration permit in the Northwest Alaska Brown Bear Management Area for subsistence purposes	1 Sep–31 May	
Nonresidents:		No open season

The trophy season in Unit 23 for resident and nonresident hunters during the reporting period was 1 September to 10 October and 15 April to 25 May. The bag limit for resident hunters was 1 bear every 4 years. The bag limit for nonresident hunters was 1 bear every 4 years by drawing permit. We issued 25 permits: 7 in the spring and 18 in the fall.

Resident hunters may also choose to hunt brown bears in the Northwest Alaska Brown Bear Management Area under a subsistence registration permit. This 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 that went into effect in July 1992, residents may harvest 1 bear per regulatory year from 1 September through 31 May. 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, it must be sealed. Department staff will remove the head and paws when they seal the hide to destroy its trophy value.

Board of Game Actions and Emergency Orders. At the spring 1996 Board of Game meeting, residents in Unit 21D and the remainder of Unit 24 expressed interest in harvesting brown bears for meat rather than for trophy or sport. Residents proposed to add these units to the Northwest Alaska Brown Bear Management Area. The board approved this proposal effective fall 1996.

Hunter/Trapper Harvest. During 1994–1995, hunters killed 32 bears (24 males, 7 females, and 1 of unknown sex) (Table 1). Hunters harvested 2 bears under the subsistence registration hunt in Unit 23. In 1995–1996, hunters killed 34 bears (25 males and 9 females). Hunters participating in the subsistence registration hunt took 6 of the 34 bears.

As in previous years, hunters harvested a larger percentage of male than female bears, especially in the spring (Table 1). Given the low percentage of the actual harvest that is reported by local hunters (Loon and Georgette 1989), the value of sex and age analysis 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 as they are in other units. Numerous hunters indicate they purchase a tag in case a bear becomes a problem at their camp rather than to actively hunt a brown bear. The high proportion of unreported harvested bears makes monitoring these populations extremely difficult.

Permit Hunts. The demand by nonresidents for fall brown bear permits exceeded the 18 permits available by 5 in 1994 and by 6 in 1995. Only 1 applicant did not receive a spring brown bear permit in 1995, and all applicants received permits in the 1996 spring drawing. The success rate for nonresident hunters accompanied by guides was 36–50% in fall hunts and 75–83% for spring hunts. These data are slightly lower than in previous years (Table 2). Seven permit holders (4-fall and 3-spring) did not hunt in 1994–1995, and 2 (1-fall and 1-spring) did not hunt in 1995–96.

Participation in the NWABBMA registration hunt continues to be primarily by residents of the management area (Table 3). Most bears harvested by hunters with registration permits in the NWABBMA were in Unit 23 (Table 4). The harvest continues to be low and evenly divided between spring and fall (Table 5). The number of bears reported harvested by local residents for all hunts does not appear to be increasing as a result of this registration hunt (Table 6).

We suspect staff and vendor efforts heavily influence the number of hunters participating in the subsistence registration hunt. The decrease in Unit 23 hunters who registered for this hunt, 63 in 1993–1994 to only 27 in 1994–1995, may be due to fewer follow-up phone contacts. These calls offered hunters an opportunity to receive a permit by mail for the next year's hunt. We found that 1 reminder letter followed by a phone call improved reporting compliance for those who picked up permits (73–87%). Comments from hunters participating in the permit system show continued support for the new subsistence hunt. Noticeably absent from this hunt are hunters from villages along the Kobuk River. Subsistence harvest studies conducted in 1987 estimated these villages harvested between 11 and 15 brown bears annually for human consumption (Loon and Georgette 1989).

Hunter Residency and Success. Local residents of Unit 23 reported taking fewer bears than did nonlocal residents (Table 6). High noncompliance with harvest reporting by local residents (Loon and Georgette 1989) makes comparisons of harvests for local and nonlocal hunters difficult to interpret.

Harvest Chronology. As in past years, most of the reported harvest was in the fall season (Table 7) with 65–72% in the Noatak and Wulik River drainages.

Transport Methods. Most hunters used aircraft to access hunting areas in the fall and snow machines during spring (Table 8). The use of ATVs in Unit 23 is increasing as guides and outfitters base ATVs at remote camps.

Other Mortality

Resident hunters killed 1 bear in defense of life or property (DLP) in 1994–1995 and 1 bear in 1995–1996.

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 established bear denning areas around the mine.

CONCLUSIONS AND RECOMMENDATIONS

1 Conduct a minimum of 1 spring reconnaissance flight in the upper Kobuk and Noatak River drainages annually to increase familiarity with bear distribution and densities.

2 Monitor FWS efforts to document den site densities.

3 Develop and evaluate an alternative harvest reporting system that would include grizzly bears.

4 Continue to inform local residents of the new subsistence grizzly bear regulations. Staff should focus on the upper Kobuk villages and continue to issue permits by phone. A current hunting license should not be a prerequisite to obtaining a registration permit.

5 Census the Red Dog Mine area before additional development occurs in adjacent exploration areas. We should inform appropriate state and federal agencies of areas around the mine containing numerous den sites.

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Table 1 Unit 23 grizzly bear harvest[a], 1985–1986 through 1995–1996

	Reported harvest				Nonhunting harvest			Estmated harvest
Year	M	F	Unk	Total	M	F	Unk	Total
1985								
Fall 1985	7	4	2	13				
Spring 1986	7	2	0	9				
Total	14	6	2	22	1	3	1	27
1986								
Fall 1986	11	9	0	20				
Spring 1987	11	2	0	13				
Total	22	11	0	33	1	2	1	37
1987								
Fall 1987	12	7	1	20				
Spring 1988	3	0	0	3				
Total	15	7	1	23	0	0	0	23
1988								
Fall 1988	11	4	0	15				
Spring 1989	14	4	1	19				
Total	25	8	1	34	2	0	0	36
1989								
Fall 1989	9	9	2	20				
Spring 1990	10	1	0	11				
Total	19	10	2	31	2	3	0	36
1990								
Fall 1990	9	10	0	19				
Spring 1991	14	3	0	17				
Total	23	13	0	36	1	1	1	39

Table 1 continued

	Reported harvest				Nonhunting harvest			Estmated harvest
Year	M	F	Unk	Total	M	F	Unk	Total
1991								
Fall 1991	10	5	1	16				
Spring 1992	15	4	0	19				
Total	25	9	1	35	1	0	0	36
1992								
Fall 1992	22	12	0	34				
Spring 1993	7	0	0	7				
NWBBMA	5	2	0	7				
Total	34	14	0	48	4	1	0	53
1993								
Fall 1993	15	4	0	19				
Spring 1994	12	1	0	13				
NWBBMA	2	1	1	4				
Total	29	6	1	36	1	0	1	38
1994								
Fall 1994	15	7	0	22				
Spring 1995	8	0	0	8				
NWBBMA	1	0	1	2				
Total	24	7	1	32	1	0	0	33
1995								
Fall 1995	18	7	0	25				
Spring 1996	5	2	0	7				
NWBBMA	4	0	2	6				
Total	27	9	2	38	1	0	0	39

[a] Includes spring and fall nonresident permit hunts.
[b] Includes DLP, research mortalities, and other human-caused accidental mortality.

Table 2 Unit 23 brown bear nonresident drawing permit hunt results, Fall 1988 through Spring 1995

	Hunting success of drawing permitees									
	Successful		Unsuccessful		Did not hunt		No report		Number of	Permits
Year	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	applicants	Available
1988 Fall	8	(61)	5	()	3	()	2	()	39	18
Spring	3	(100)	0		4	()	0		17	7
1989 Fall	7	(58)	5	()	5	()	1	()	42	18
Spring	5	(100)	0		2	()	0		13	7
1990 Fall	7	(58)	5	()	2	()	0		31	18
Spring	6	(100)	0		1	()	0		15	7
1991 Fall	7	(47)	8	()	1	()	0		26	18
Spring	5	(83)	1	()	0		0		6	6
1992 Fall	7	(64)	4	()	7	()	0		21	18
Spring	2	(100)	0		4	()	1	()	11	7
1993 Fall	7	(54)	6	()	1	()	1	()	21	18
Spring	5	(83)	1	()	1	()	0		5[a]	7
1994 Fall	4	(36)	7	()	4	()	3	()	23	18
Spring	3	(75)	1	()	3	()	0		8	7
1995 Fall	8	(50)	8	()	1	()	1	()	24	18
Spring	5	(83)	1		1		0		7	7

[a]Staff issued the two undrawn permits over the counter.

Table 3 Permits issued by hunter residency for Northwest Alaska Brown Bear Management Area registration hunt 1992–93 through 1995–1996

Regulatory	Residency of hunters					No. hunters reporting	
year	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

Table 4 Brown bears harvested during Northwest Alaska Brown Bear Management Area registration hunt, 1992–1993 through 1995–1996

Regulatory	Sex of harvested grizzly bears			Harvest by Game Management Unit			
year	M	F	Unk	Total	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

Table 5 Monthly harvest of grizzly bears during the first 3 years of the Northwest Alaska Brown Bear Management Area registration hunt, 1992–1993 through 1995–1996

Regulatory	Number of grizzly bears harvested									
year	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	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

Table 6 Unit 23 grizzly bear harvest[a] by hunter residency, 1985–1986 through 1995–1996

Regulatory year	Unit 23 resident	Nonlocal resident	Nonresident	Total
1985–1986	9	3	19	22
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

[a] Includes nonresident permit hunts and excludes nonhunting moralities.

Table 7 Monthly harvest of grizzly bear in Unit 23 from 1985–1986 through 1995–1996

Regulatory	August		September		October		April		May		Other		
year	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	Total
1985–1986	-		13	(59)	-		4	(18)	5	(23)			22
1986–1987	-		20	(61)	-		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				48
1993–1994			19	(53)	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

[a] Excludes nonhunting mortalities.
[b] Harvested in December.

Table 8 Number of grizzly bears harvested in Unit 23 by transport method, 1985–1986 through 1995–1996

Regulatory year	Airplane	Boat	4-wheeler/ ORV	Snowmachine	Other	Unknown	Total
1985–1986	15	1	-	5	-	-	22
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

[a] One hunter indicated he used a boat in conjunction with an airplane; 2 hunters indicated they used 4-wheelers 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 the area with higher numbers in more mountainous areas. Upland areas compose about one-third of the unit. Information is scant about bear populations within the unit, and most past references about bear density were based on 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).

The harvest since 1961 has rarely exceeded 15 grizzly bears/year. An exception to this pattern occurred in the early 1970s when bear hunting on the Alaska Peninsula was closed on an alternate year basis; this resulted 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 overharvest, a drawing permit system was in place from 1977 to 1985.

Observations indicate bear populations are stable and may be slowly increasing; annual harvests have been low, usually less than 15 bears. Local hunting pressure has been low, although the opening of the Dalton Highway to the public increased the number of potential hunters. Historically, grizzly bears were an important source of food and hides for local people; however, except for residents of Anaktuvuk Pass, unit residents have greatly reduced their hunting effort for grizzly bears.

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

- Manage 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 US National Park Service and US Fish and Wildlife Service to determine bear density throughout the unit.

METHODS

We monitored harvest through sealing requirements. The nuisance bear problem will be addressed through education of local residents, selective removal of problem bears, and changes in regulations.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The grizzly bear population in Unit 24 is believed stable or slowly increasing, based on field observations, nuisance reports, and hunter sightings of bears during the past 10 years. Also, the total estimated harvest has been less than 4% of the grizzly bear population per year, which may contribute to an increasing population.

No surveys have been conducted in the area; however, population estimates were made based on bear densities found in similar habitats on the northern slopes of the Brooks Range. In the mountains, foothills, and coastal plain of the Canning River area, bear densities ranged from 10.0 to 17.5 bears/1000 mi^2 (Reynolds 1976). In contrast, in a study area in the western Brooks Range, densities were about 40 bears/1000 mi^2; these higher densities were probably because of the large number of caribou in the area (Reynolds and Hechtel 1984). In 1987 Reynolds (1989) estimated the density of bears within Gates of the Arctic National Park (7000 mi^2) at 33 bears/1000 mi^2. Outside the park within the Brooks Range (6500 mi^2), Reynolds estimated the density at 33/1000 mi^2, and in the remainder of the unit (14,500 mi^2) he estimated the density at 22 to 33 bears/1000 mi^2. Because most of Unit 24 has a fairly substantial ungulate prey base and spawning salmon streams, Reynolds' (1987) estimate of 770 to 930 is probably close to the Unit 24 population.

MORTALITY

Harvest

Hunting pressure on bears in the southern part of the unit is low, although the season length has been liberalized from 55 days during 1981–1983, to 137 days during 1984–1989, and to 273 days since 1990–1991. The average annual harvest of bears by hunters from fall 1989 through spring 1996 is 11.14 bears (Table 1). The number of bears that were taken at fish camps and by trappers and not reported is unknown but is estimated to be less than 4 bears annually.

Seasons and Bag Limits.

Units and Bag Limits	Resident Open Season	Nonresident Open Season
Unit 24, (Northwest Alaska Brown Bear Management Area). One bear every regulatory year by registration permit.	1 Sep–31 May (Subsistence hunt only)	No open season
Unit 24 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 is now aligned with seasons in Units 19, 20, and 21. In 1992 the board adopted 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 is 1 bear per year. There is no fee, aircraft cannot be used, all meat must be salvaged, and sealing requirements are waived if the hide and skull remain within the management area. 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 Residency and Success. Harvest has been stable, but some changes may occur as new guide/outfitter areas are established. Most bear hunting is now incidental to fall moose hunting by Alaska residents (Tables 1 and 2). Very few nonresidents are currently participating in spring bear hunts.

CONCLUSIONS AND RECOMMENDATIONS

The management objective for grizzly bears within the unit is to maintain a grizzly bear 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. The mean annual reported and estimated unreported harvest for the entire unit was estimated at an average of 17 bears per year. Based on the estimated sustainable harvest rate of 5% to 6% elsewhere in Interior Alaska, a harvest of 39 to 47 bears could be sustained in this unit. There is some likelihood that localized overhunting could occur. However, the grizzly bear population is probably not susceptible to overharvest because hunting is restricted within Gates of the Arctic National Park. Much of the rest of the unit is more heavily

forested and difficult to hunt; within 5 miles of the Dalton Highway firearms cannot be used to hunt.

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Table 1 Residency of successful grizzly bear hunters, Unit 24, 1989–1996

Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Total successful hunters
1989–1990	1	5	4	10
1990–1991	3	9	3	15
1991–1992	0	4	4	8
1992–1993	2	7	6	13
1993–1994	0	5	2	7
1994–1995	2	10	4	16
1995–1996	1	7	1	9
Fall 1996	0	7	5	12

[a] Unit residents.

Table 2 Unit 24 grizzly bear harvest, 1989–1996

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
1989-1990														
Fall 1989	4	2	1	7	0	0	0	0	n/a	n/a	4	2	1	7
Spring 1990	1	1	0	2	0	0	0	0	n/a	n/a	1	1	n/a	2
Total	6	3	1	10	0	0	0	0	3	2	6	3	6	15
1990-1991														
Fall 1990	8	5	0	13	0	1	0	1	n/a	n/a	8	5	n/a	14
Spring 1991	0	2	0	2	0	0	0	0	n/a	n/a	0	2	n/a	2
Total	8	6	0	14	0	1	0	1	3	2	8	7	5	20
1991-1992														
Fall 1991	5	2	0	7	0	0	0	0	n/a	n/a	5	2	n/a	7
Spring 1992	1	0	0	1	0	0	0	0	n/a	n/a	1	0	n/a	1
Total	6	2	0	8	0	0	0	0	3	2	6	2	5	13
1992-1993														
Fall 1992	6	5	0	11	0	0	1	1	n/a	n/a	6	5	1	12
Spring 1993	4	0	0	4	0	0	0	0	n/a	n/a	4	0	n/a	4
Total	10	5	0	15	0	0	1	1	3	2	10	5	6	21
1993-1994														
Fall 1993	5	0	0	5	0	0	1	1	n/a	n/a	5	0	1	6
Spring 1994	2	0	0	2	1	0	0	1	n/a	n/a	3	0	0	3
Total	7	0	0	7	1	0	1	2	3	2	8	0	1	9
1994-1995														
Fall 1994	6	8	0	14	0	0	0	0	n/a	n/a	6	8	0	14
Spring 1995	1	1	0	2	0	0	0	0	n/a	n/a	1	1	n/a	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	2	0	2	n/a	n/a	4	6	n/a	10
Spring 1996	0	1	0	1	0	0	0	0	n/a	n/a	0	1	n/a	1
Total	4	5	0	9	0	2	0	2	3	2	4	7	5	16
1996-1997														
Fall 1996	8	4	0	11	0	0	0	0	n/a	n/a	8	4	n/a	12

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

LOCATION

GAME MANAGEMENT UNIT: 25A, 25B, 25D, 26B, and 26C (75,000 mi^2)

GEOGRAPHIC DESCRIPTION: Eastern North Slope of the Brooks Range and the upper Yukon River Drainage

BACKGROUND

The reduction in brown bear numbers in the 1960s, primarily from aircraft-supported hunting associated with guiding, was initially followed by conservative management; gradual liberalization of regulations has occurred as populations recovered. Units 26B and 26C were closed to brown bear hunting in 1971–1972, and a variety of regulations including drawing permit hunts were used to limit harvest and foster an increase in numbers. A harvest objective of 4–6% of the estimated populations has been used in recent years.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

Management goals for the area's brown bears are to: 1) protect, maintain, and enhance the brown bear populations and habitat in concert with other components of the ecosystem; 2) provide the opportunity to hunt brown bears under aesthetically pleasing conditions in the eastern Brooks Range; and 3) in the upper Yukon and Porcupine drainages, provide the greatest sustained opportunity to participate in hunting brown bears.

MANAGEMENT OBJECTIVES

Unit 25

- Maintain a brown bear population capable of sustaining a mean annual harvest of 58 bears, with a minimum of 60% males in the harvest.

Units 26B and 26C

- Maintain a brown bear population capable of sustaining a mean annual harvest of 32 bears, 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), and observations by area residents and others with a long-term familiarity with the area. Harvest data are obtained from mandatory sealing documents.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The reduction in harvest resulting from conservative regulations, including the permit system used since 1977, has fostered recovery in the number of brown bears in Units 25A, 26B, and 26C following overharvest in the 1960s. Bear numbers in Unit 25A seem to be stable or increasing. The trend in Units 26B and 26C seems to be stable. The long-term population trend in Units 25B and 25D is less well known, but brown bears are common throughout the area and numbers seem to be stable or increasing. People familiar with these areas generally report that brown bears are more abundant than in the past. Residents of the Yukon Flats report that brown bears were relatively scarce during much of this century. Numbers have increased in the last 10 to 20 years, probably because the number of bears harvested locally declined.

Population Size

Population estimates were revised in 1993 as part of a statewide effort to update brown bear population estimates. Current estimates are based 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 calculations of land area based on computer digitization of game management units.

Current estimates of bear numbers (Table 1) are somewhat higher than previous estimates, largely because of increased knowledge of bear densities and, to a lesser extent, because previous calculations of land area were lower than current measurements. The total number of bears in the eastern Brooks Range and upper Yukon River drainage is currently estimated at 1817 (Table 1).

Distribution and Movements

Brown bears are distributed throughout the area. Densities are 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 has developed near Prudhoe Bay as a result of the availability of discarded food primarily available in dumpsters and in the Prudhoe Bay landfill, with 23 brown bears found in an area of 1500 mi^2 (R Shideler, pers commun). We have 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 within the Hodzana River drainage. One bear every 4 regulatory years.	1 Sep–20 May	1 Sep–20 May
Units 25B and 25D. One bear every 4 regulatory years.	1 Sep–31 May	1 Sep–31 May
Unit 26B (Regulatory years 1994-1995 and 1995-1996).		
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 may be issued.		1 Sep–20 May
Unit 26B (Regulatory year 1996-1997). One bear every 4 regulatory years.	1 Sep–31 May	1 Sep–20 May
Unit 26C. One bear every 4 regulatory years.	1 Sep–31 May	1 Sep–20 May

Board of Game Actions and Emergency Orders. Drawing permits were required for all brown bear hunters in Units 25A, 26B and 26C beginning in 1977-1978. As bear populations recovered, regulatory changes included applying the permit requirement to nonresidents only and slight increases in 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 1994-1995, and in Unit 26B, beginning in 1996-1997.

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.

The new regulation was established with widespread support from guides, and with the understanding that guides and ADF&G would work together to keep harvests within sustainable limits and maintain a high percentage of males in the harvest.

Based on similar reasoning and willingness of guides in the unit to voluntarily adjust their efforts to keep within sustained yield, the permit system for nonresidents in Unit 26B was reevaluated and eliminated by the Board of Game beginning in regulatory year 1996–1997. The board also established an earlier season opening date of 20 August in Units 26B and 26C.

Hunter Harvest. The total annual harvest from 1988–1989 to 1995–1996 ranged from 30 to 49 (Tables 2-5). Most were taken in Units 25A, 26B and 26C. The overall harvest has been nearly stable in recent years. Increased bear numbers and a gradual liberalization of regulations resulted in higher harvests than during the late 1970s and early 1980s but still below the estimated sustainable yield of 5%, except in Unit 26B.

The only area where harvests continue to approach or exceed the harvest objective is Unit 26B, where from 11 to 17 bears have been taken in each of the last 6 years (Table 4). While the harvest exceeded the objective of 13 bears in 3 of the last 6 years, mean annual harvest is only 5.4% of the estimated population (range = 4.6–6.5%). Reports from hunters and casual observations indicate that bears continue to be common in Unit 26B. 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 67% in 1994-1995 and 68% in 1995-1996. The sex composition of the harvest generally meets the objective of a minimum of 60% males (Tables 3-5). Most bears are taken during fall hunts.

Permit Hunts. During 1994-1995 and 1995-1996 drawing permits were required for nonresident hunters in Unit 26B but not for Alaska residents. The fall, spring, and total harvest is given in Table 6. Harvests by permit holders in 1994-1995 and 1995-1996 were 3 and 5, compared with total harvests in the permit areas of 12 and 11, respectively. Most brown bears are taken during fall hunts.

Hunter Residency and Success. Residents accounted for 67% and 32% of the successful hunters in Units 25A, 25B, 25D, 26B, and 26C during the 1994-1995 and 1995-1996 seasons, respectively (Tables 7-10). Only a few local residents report taking bears. These figures probably underestimate the number taken by local hunters by a small amount, particularly in Units 25A, 25B and 25D.

Transport Methods. Most brown bears are harvested in aircraft-supported hunts, with a few being taken by hunters using snowmachines or boats; highway vehicles are used near the Dalton Highway.

Other Mortality

The number of brown bears taken and not reported is unknown, but there are occasional reports of bears being killed but not sealed, especially near villages. Some of this harvest

probably occurs in DLP incidents. Local residents of this area do not often specifically hunt bears but commonly encounter them in the course of other activities. More education among local residents about the need for harvest reporting and sealing is 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

Current management objectives are generally being met in the area, and harvests are at or below sustainable levels. The one area where annual harvest is sometimes greater than the objective is in Unit 26B where in the last 6 years hunters have taken 11–17 bears. The current harvest objective is 13 bears.

Results of a 1994 bear management workshop indicate the current approach to setting brown bear population management objectives should be modified to emphasize limiting the harvest of female bears. I suggest the following revised management objectives for Units 25A, 25B, 25D, 26B, and 26C. The maximum harvest for females is based on the goal of maintaining 60% males in the harvest.

UNIT 25

- Maintain a brown bear population capable of sustaining a mean annual harvest of 58 bears.

- Maintain the number of breeding females by harvesting an average of no more than 23 female bears.

UNITS 26B AND 26C

- Maintain a brown bear population capable of sustaining a mean annual harvest of 32 bears.

- Maintain the number of breeding females by harvesting an average of no more than 13 female bears.

The elimination of the permit requirement for nonresidents in Units 25A and 26C provides an opportunity to establish a management partnership with guides. Increased communication between resource managers and users can foster better management of brown bear populations under a system that is more workable for all concerned. It is as important for the department to follow through in making the new system work as it is for guides to stay within sustainable harvest levels.

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Table 1 Population parameters and estimated sustainable harvest for brown bears in Units 25A, 25B, 25D, 26B, and 26C, 1993

Area	Area (mi^2)	Estimated density/100 mi^2	Estimated population size	Allowable harvest (at 5%)
25A	21,280	2.8	584	29
25B and D	26,660	2.2	580	29
26B	15,500	1.7	262	13
26C	10,272	3.8	391	19
Total	73,712	2.5	1817	90

Table 2 Unit 25A brown bear harvest[ab], 1989–1995

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
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

[a] Note whether permit hunt harvest is included or excluded.

[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[a], 1989–1995

Regulatory year	Reported								Total estimated kill					
	Hunter kill					Nonhunting kill[b]								
	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														
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

[a] Note whether permit hunt harvest is included or excluded.

[b] No estimate was made of unreported or illegal kills.

Table 4 Unit 26B brown bear harvest[a], 1989–1995

Regulatory year	Reported								Total estimated kill					
	Hunter kill					Nonhunting kill[b]								
	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														
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

[a] Note whether permit hunt harvest is included or excluded.

[b] No estimate was made of unreported or illegal kills.

Table 5 Unit 26C brown bear harvest[a], 1989–1995

Regulatory year	Reported								Total estimated kill					
	Hunter kill					Nonhunting kill[b]								
	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														
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

[a] Note whether permit hunt harvest is included or excluded.

[b] No estimate was made of unreported or illegal kills.

Table 6 Unit 26B brown bear harvest data by permit hunt, 1987–1995

Hunt No./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
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
Totals for all permit hunts	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	4	2	0	6
	1989-1990	n/a	n/a	n/a	n/a	n/a	n/a	7	7
	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

Table 7 Unit 25A residency of successful brown bear hunters[a], 1985–1995

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

[a] Note whether hunters in permit hunts are excluded.

[b] Includes only residents of the subunit.

Table 8 Unit 25B and 25D residency of successful brown bear hunters[a], 1985–1995

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

[a] Note whether hunters in permit hunts are excluded.

[b] Includes only residents of the subunit.

Table 9 Unit 26B residency of successful brown bear hunters[a], 1985–1995

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

[a] Note whether hunters in permit hunts are excluded.

[b] Includes only residents of the subunit.

Table 10 Unit 26C residency of successful brown bear hunters[a], 1985–1995

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

[a] Note whether hunters in permit hunts are excluded.

[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. Throughout the years, interest in hunting bears has remained high 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

1 Maintain a grizzly bear population of approximately 800 bears or greater

2 Maintain a harvest success rate of at least 60%

3 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, and results have been 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 of bears in each permit hunt and in the general hunt. For sealed bears we summarized the date and location of kill, skull sizes, and sex/age composition of harvested animals. We summarized hunting activity 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, pers. commun.).

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, pers. commun.) and have been recovering since permit hunts were instituted during the 1977–78 regulatory year (Trent 1988). Bear densities seem 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 Hunters: 1 bear every 4 regulatory years	1 Sep–31 May	
Nonresident Hunters: 1ne bear every 4 regulatory years by drawing permit. Up to 12 permits may be issued in Unit 26A East and up to 22 permits may be issued in Unit 26A West.		1 Sep–20 May
Unit 26A- Subsistence Hunt Resident Hunters: 1 bear per regulatory year by registration permit in the Northwest Alaska Brown Bear Management Area for subsistence purposes.	1 Sep–31 May	
Nonresidents		No open season

Board of Game Actions and Emergency Orders. The Board of Game included Unit 26A in the NWABBMA subsistence registration hunt for the 1993–1994 regulatory year. Alternate regulations allow resident hunters 1 bear per year, the resident brown bear tag is not required, the hide and skull need not be salvaged, and the hide does not need to be sealed if it stays within the management area. Hunters are required to obtain a registration permit and carry it while hunting, salvage the meat for human consumption, and destroy the trophy value of the hide if it is removed from the management area. Aircraft may not be used in any manner for hunting. Hunters are contacted by mail to obtain harvest information.

Beginning with the 1993–94 season, permits not issued in undersubscribed drawing permit hunts were available on a first-come, first-served basis at the Fairbanks ADF&G office 5 days following the drawings.

During their spring 1996 meeting, the Board of Game approved a proposal that eliminated the drawing permit requirements for nonresident brown bear hunters in Unit 26A and lengthened the season to 20 August–20 May. The change was to simplify the complex permit system, attempt to harvest Unit 26A to maximum sustained yield, and to increase hunting in the unit. 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, the quota for the next year will be reduced by as much as it was exceeded the first year. If the average is exceeded, more restrictive regulatory action will be considered, including emergency orders. The system will depend upon open lines of communication between the department, guides, and hunters.

Hunter/Trapper Harvest. Twenty bears were sealed during 1994–1995. Seven bears were killed in Unit 26A West and 13 in Unit 26A East (Table 1). Sixteen bears were males and 4 were females (Table 2).

Twenty-three bears were sealed during 1995–1996. Two bears were killed in defense of life or property (DLP). Six bears were killed in Unit 26A West and 17 in Unit 26A East (Table 1). Thirteen bears were males, 9 were females, and 1 was of unknown sex (Table 2).

The reported harvests in 1994–1995 and 1995–1996 were similar to those 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 1994–1995, the mean skull size for males was 21.4 inches and 18.8 inches for females; the mean age was 7.7 years for males and 3.5 years for females. During 1995–1996 the mean skull size for males was 21.2 inches and 19.1 inches for females; the mean age was 8.1 years for males and 6.1 years for females (Table 3).

Permit Hunts. Bears were harvested under 4 nonresident permit hunts in Unit 26A. Hunts 985 and 995 were for Unit 26A East, and Hunts 986 and 996 were for Unit 26A West. The seasons for all permit hunts are the same (1 Sep–20 May), but drawings are held for Hunts 995 and 996 in December, so they are in effect spring hunts. The number of hunters, success rate, and number and sex of animals harvested are summarized in Table 4.

In 1994–1995, 6 hunters registered to hunt in the Northwest Alaska Brown Bear Management Area Registration Permit hunt, and 1 bear was reported harvested. In 1995–1996 5 hunters registered and, again, 1 bear was reported harvested.

Hunter Residency and Success. Of the 20 bears sealed in Unit 26A during 1994–1995, 15 were harvested by nonresidents, 5 by nonlocal Alaska residents, and zero by North Slope residents. During 1995–1996, 13 of 23 bears were harvested by nonresidents, 4 by nonlocal Alaska residents, and 6 by North Slope residents (Table 5). Nonresident success rate was 83% during 1994–1995 and 75% during 1995–1996 (Table 4). No data on success rates are available for resident hunters.

Harvest Chronology. During 1994–1995 12 bears were harvested during September, and 8 were harvested in May. In 1995–1996 11 bears were harvested in September, 2 in October, 2 in April, and 8 in May (Table 6).

Transport Methods. Most bear hunters continued to use aircraft as transportation in Unit 26A. During 1994–1995, 15 hunters used aircraft for transportation, 3 used snowmachines, 1 used a boat, and 1 walked. Twelve hunters used aircraft during 1995–1996, 7 used snowmachines, 2 used boats, and 1 walked (Table 7).

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 during 1977–81.

HABITAT

Assessment

Most 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. Bears may also be limiting the Colville River moose calf population, which has suffered declines in spring and summers. To determine whether bears are increasing moose calf mortality, we will conduct aerial surveys during moose calving season.

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, pers. commun.). An attempt should be made to catalogue as many of these areas as possible. These areas should be considered brown bear critical habitat and in the future be given special protection.

Enhancement

There were no habitat enhancement activities in Unit 26A during the reporting period.

CONCLUSIONS AND RECOMMENDATIONS

The 1994–1995 and 1995–1996 reported harvests of 20 and 23 bears, respectively, as well as previous yearly harvests, were well below the allowable sustained yield of approximately 51 bears. Because the harvest in Unit 26A has been well below the maximum sustained yield and the permit hunt was undersubscribed, the Board of Game passed a proposal which liberalized bear harvest regulations by discontinuing the permit drawing system and lengthening the season to August 20–May 20. We replaced the permit hunt with a 2-year quota system. If hunters exceed the maximum allowable harvest of bears during year 1, the allowable harvest for year 2 will be reduced by the number they exceeded the quota during year 1. If the average is exceeded, more restrictive regulatory action, including emergency orders, will be considered. We set maximum harvest levels based upon current bear population estimates, and hunters will be allowed a total harvest of 31 bears per year in Unit 26A East and 20 bears in Unit 26A West. The change was made to simplify the complex permit system. The new system will depend on establishing lines of communication and the cooperation of guides and hunters.

Moose calf survival has been very low for the last 3 years in Unit 26A with most calves being lost during spring and early summer. This indicates bear predation may be a factor affecting moose calf survival. In coming years, aerial surveys during and after the moose calving period will be used to help assess moose calf mortality factors.

Oil and mineral exploration and development are potential hazards to brown bear habitat. Reynolds (pers. commun.) has stated that some areas, particularly some east/west-oriented ridges, have very high brown bear densities. We should attempt to locate as many of these critical habitat areas as possible 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 NWABBMA with alternate hunting regulations for subsistence users in 1992. The regulations are designed for people who hunt bears for food; these 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 neither buy hunting licenses nor report their harvest. To alleviate this problem, department personnel have been assisting the North Slope Borough 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. We will have more accurate harvest information as the NSB program becomes established in the rest of the North Slope villages.

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Table 1 Reported harvest of brown/grizzly bears in Unit 26A, 1988–1994

Unit	Estimated population size	Harvest of 5%	Reported harvest							
			1988–89	1989–90	1990–91	1991–92	1992–93	1993–94	1994–95	1995–96
26A West	400	20	25	12[a]	16	13[A,]	16	9[a]	7	6
26A East	500–720	25-36	6	14	16[a]	21	13	17	13	17[a]
Total	900–1200	45-56	31	26[a]	32[a]	34[a]	29	26[a]	20	23[a]

[a] Includes DLP-killed bears

Table 2 Unit 26A brown bear harvest[a], 1985–1996

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

Table 2 Continued

Regulatory year	Hunter harvest M	(%)	F	(%)	Unk.	Total	Non-hunting kill	Total	Unreported est. kill	Total est. kill
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
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

[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, 1985–1996

Regulatory	Mean skull size, inches				Mean age, years			
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

Table 4 Unit 26A brown bear harvest data by permit hunt, 1988–1996

Regulatory year	Permit hunt nr.	Permits issued	Number of hunters						Number of brown bears						Total harvest
			Did not hunt		Unsuccessful		Successful		Male		Female		Unknown		
			n	(%)[a]	*n*	(%)[b]	*n*	(%)[b]	*n*	(%)[c]	*n*	(%)[c]	*n*	(%)[c]	
1988-1989															
Fall 1988	291/293	21	8	(38)	1	(8)	12	(92)	8	(67)	4	(33)			12
Spring 1989	292/294	9	1	(11)	0		8	(100)	7	(88)	1	(12)			8
Total		30	9	(30)	1	(5)	20	(95)	15	(75)	5	(25)			20
1989-1990															
Fall 1990	286/287	21	7	(33)	4	(29)	10	(71)	7	(70)	3	(30)			10
Spring 1990	295/296	9	3	(33)	3	(50)	3	(50)	3	(100)					3
Total		30	10	(33)	7	(35)	13	(65)	10	(77)	3	(23)			13
1991-1992															
1991-1992	286 East	8					8	(100)	8	(100)					8
1991-1992	287 West	11	2	(18)	1	(11)	8	(89)	6	(75)	1	(13)	1	(13)	8
Spring 1992	295 East	2	1	(50)			1	(100)	1	(100)					1
Spring 1992	296 West	1					1	(100)	1	(100)					1
Total		22	3	(14)	1	(5)	18	(95)	16	(83)	1	(11)	1	(11)	18
1992-1993															
1992-1993	286 East	8	2	(25)			6	(100)	6	(100)					6
1992-1993	287 West	14	2	(14)	3	(25)	9	(75)	9	(100)					9
Spring 1993	295 East	4	2	(50)			2	(100)	2	(100)					2
Spring 1993	296 West	6	1	(17)	2	(40)	3	(60)	2	(67)	1	(33)			3
Total		32	7	(22)	5	(20)	20	(80)	19	(95)	1	(5)			20
1993-1994															
1993-1994	985 East	8	2	(25)	1	(17)	5	(83)	5	(100)					5
1993-1994	986 West	7	2	(29)	4	(80)	1	(20)	1	(100)					1
Spring 1994	995 East	4					4	(100)	4	(100)					4
Spring 1994	996 West	10	7	(70)	1	(33)	2	(67)	1	(50)	1	(50)			2
Total		29	11	(38)	6	(33)	12	(67)	11	(91)	1	(9)			12

Table 4 Continued

Regulatory year	Permit hunt nr.	Permits issued	Number of hunters						Number of brown bears						Total harvest
			Did not hunt		Unsuccessful		Successful		Male		Female		Unknown		
			n	(%)[a]	*n*	(%)[b]	*n*	(%)[b]	*n*	(%)[c]	*n*	(%)[c]	*n*	(%)[c]	
1994-1995															
1994-1995	985 East	8	1	(13)	1	(14)	6	(86)	5	(83)	1	(17)			6
1994-1995	986 West	15	8	(53)	2	(29)	5	(71)	4	(80)	1	(20)			5
Spring 1995	995 East	4	1	(25)			3	(100)	3	(100)					3
Spring 1995	996 West	7	6	(86)			1	(100)	1	(100)					1
Total		34	16	(47)	3	(17)	15	(83)	13	(87)	2	(13)			15
1995-1996															
1995-1996	985 East	8			1	(12)	7	(88)	5	(71)	2	(29)			7
1995-1996	986 West	6	3	(50)	2	(67)	1	(33)	1	(100)					1
Spring 1996	995 East	4	1	(25)	1	(33)	2	(67)	2	(100)					2
Spring 1996	996 West	4	2	(50)			2	(100)	1	(50)	1	(50)			2
Total		22	6	(27)	4	(25)	12	(75)	9	(75)	3	(25)			12

[a] Percent of total permits issued.
[b] Percent of active hunters; does not include permittees who did not hunt.
[c] Percent of total harvest.

Table 5 Unit 26A brown bear successful hunter[a] residency, 1985–1996

Regulatory year	Local[b] 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

[a] Hunters in permit hunts are included.
[b] Local means North Slope residents.

Table 6 Unit 26A brown bear harvest chronology by month, 1985–1996

Regulatory year	Aug	Sep	Oct	Nov	Apr	May	Jun	*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

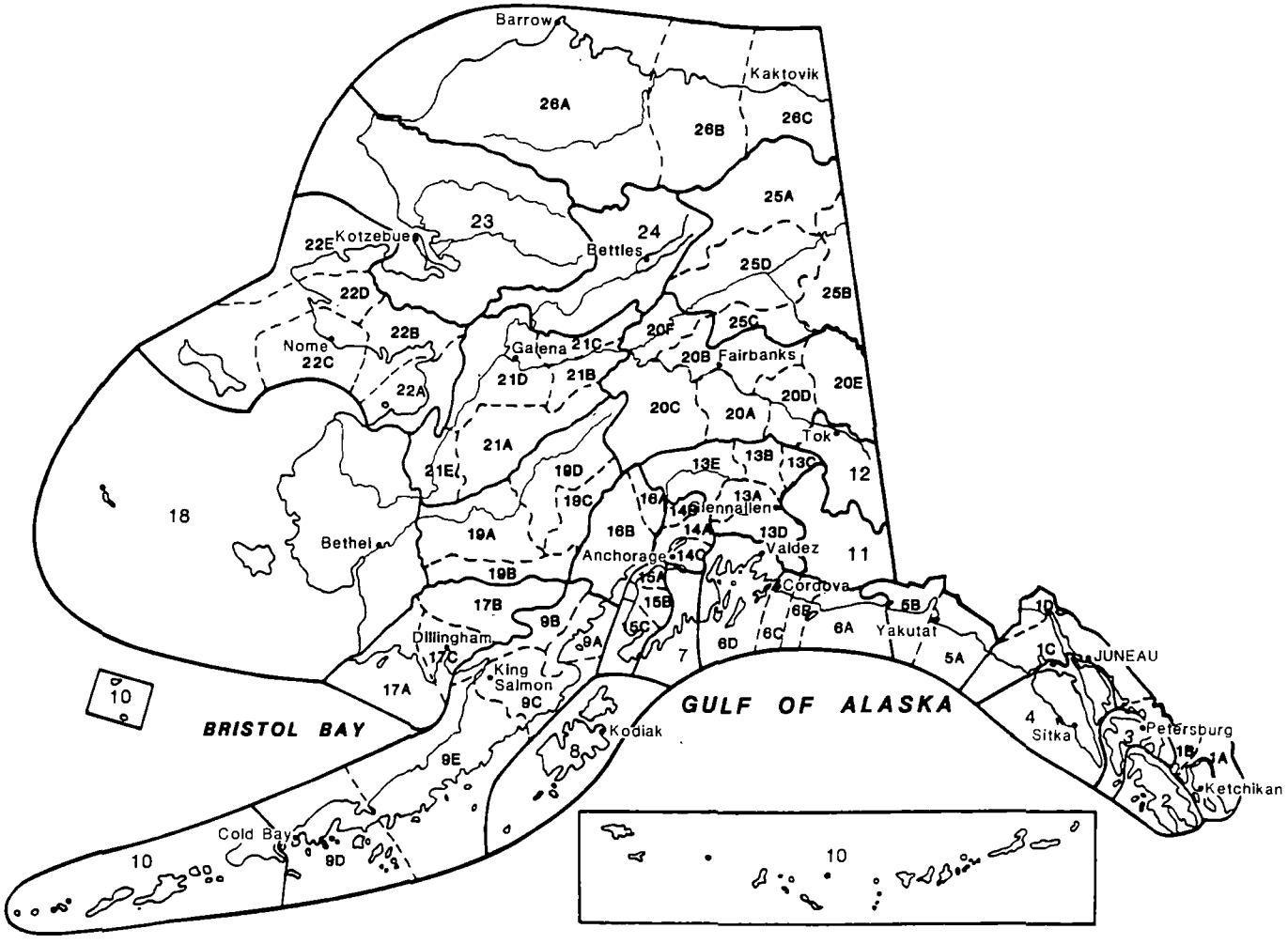
[a] DLP kill.

Table 7 Unit 26A brown bear harvest[a] percent by transport method, 1985–1996

Regulatory year	Transport method for brown bear harvest														Total
	Airplane		Horse		Boat		Snowmachine		ORV		Walk		Unknown		
	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

[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.

Ken Whitten