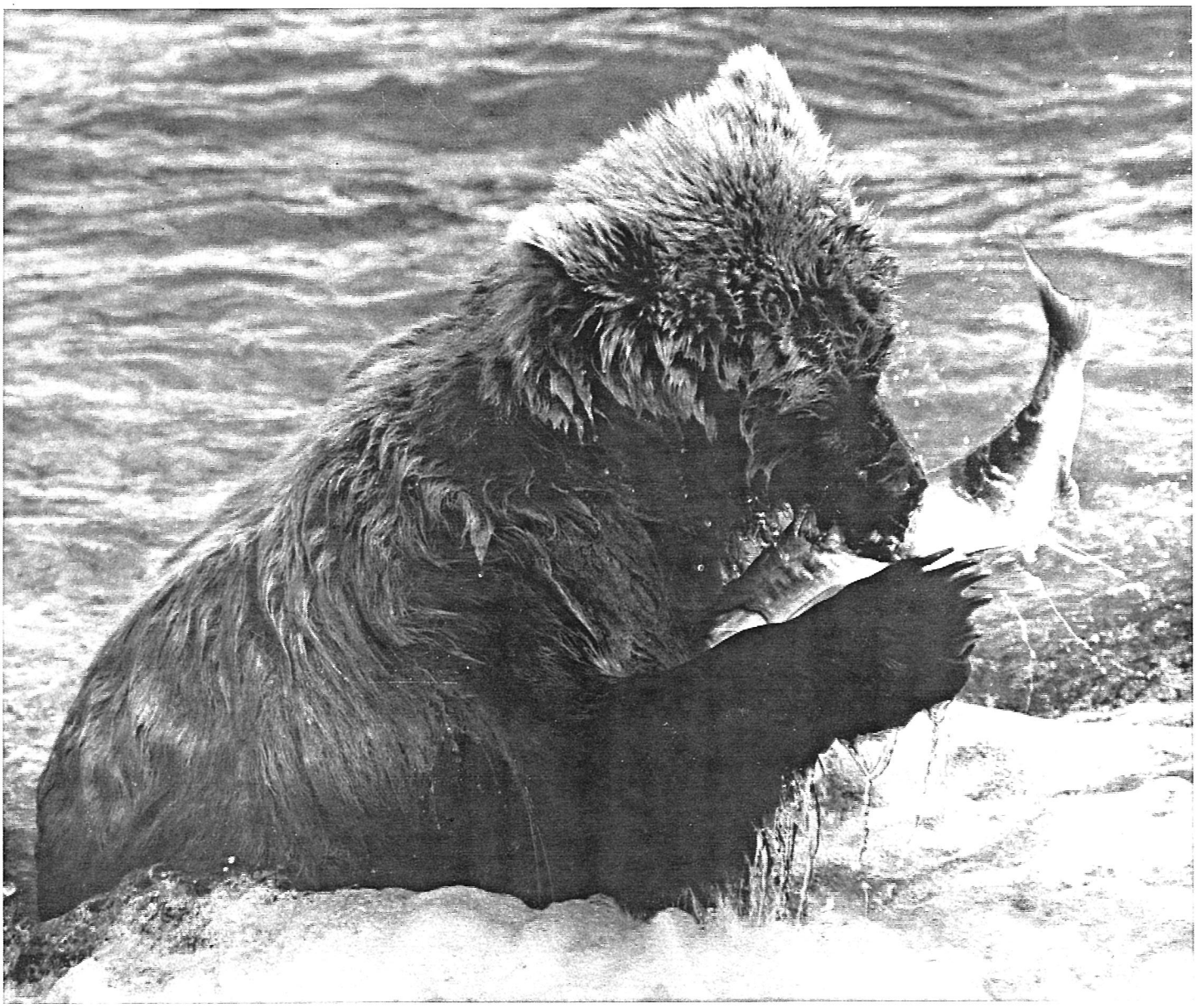
Alaska Department of Fish and Game
Division of Wildlife Conservation

Federal Aid in Wildlife Restoration
Management Report of
Survey-Inventory Activities
1 July 1992- 30 June 1994

BROWN BEAR

Mary V Hicks, Editor



LEONARD LEE RUE III

Grants W-24-1 & W-24-2
Study 4.0
December 1995

STATE OF ALASKA
Tony Knowles, Governor

DEPARTMENT OF FISH AND GAME
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DIVISION OF WILDLIFE CONSERVATION
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LOCATION

Game Management Unit: 1 (18,300 mi^2)

Geographical 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 and the coastal mainland. Although extensive research of brown bear habitat use, movement patterns, and population density has been carried out 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 bears comes from anecdotal hunter information, occasional staff observations, and mandatory sealing data.

Before the 1968 season, hunters could harvest one brown bear annually from any part of Alaska during 1 September-10 June. Since 1969, hunters have been restricted to one bear every four regulatory years. Season lengths have varied from six to nine months during the past two decades (Larsen 1993) and since 1989 have stretched five and one half months. Fall 1989 marked the first season in which Unit 1 registration permits were required (McCarthy 1991, Larsen 1993). Previously hunters were only required to obtain a license and metal-locking tag before hunting. Brown bear sealing requirements have been in effect in Alaska since 1961.

MANAGEMENT DIRECTION

Management Objectives

Our management objectives for Unit 1 brown bears are to: 1) maintain an average age of harvested males of no less than 6.5 years with a male:female harvest ratio of at least 3:2 and 2) reduce the number of bears killed because of garbage habituation.

METHODS

We collected brown bear harvest data through registration permit reports and a mandatory sealing program. We recorded the sex of harvested bears, skull measurements, and the date and location of kill at the time of sealing. We sent extracted premolar teeth to the Anchorage Alaska Department of Fish and Game (ADF&G) office for age determination.

RESULTS AND DISCUSSION

Population Status, Trend, and Composition

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

Mortality

Harvest:

Season and Bag Limit	Resident and nonresident hunters
15 Sept. - 31 Dec. 15 Mar. - 31 May	One bear every four regulatory years 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 (McCarthy 1991, Larsen 1993). To date, no emergency closures have been necessary.

Hunter Harvest. Harvest from Unit 1 subunits during 1992-94 was similar to that reported during each of the previous seven seasons (Table 1). The unitwide reported harvest of 37 brown bears during 1992-93 is the highest during the past nine seasons. Subunit 1D continues to account for nearly half of the bears harvested from the unit.

An adult sow was illegally killed along Fish Creek in Hyder during October 1992. Before the killing, department fisheries biologists had observed the sow feeding on spawning salmon with her 2 two-year-old cubs. The killers had begun to eviscerate the sow before fleeing the scene. There was no indication any body parts had been taken.

Four male brown bears were killed in defense of life and property (DLP) in Subunit 1D during spring 1993. An additional male was killed DLP in Subunit 1D in fall 1993 (Table 2). These DLP shootings occurred in or close to Haines. A sow was shot in Subunit 1C during May 1994 by a hunter without a registration permit. The bear's hide and skull were seized by the State.

Unreported kills are conservatively estimated at 10% of the reported harvest (McCarthy 1991) (Table 2). We derive total estimated harvests for Unit 1 by adding the reported harvest, DLP kills, and estimated unreported/illegal kills.

Male harvests have consistently surpassed our management objective of 60% of the total kill (Table 2). During the past two seasons, males composed 62-76% of the annual harvest. Harvests are most noticeably skewed toward males during spring seasons because, as noted by McCarthy (1991), it is illegal to harvest females accompanied by cubs and females with cubs are more

secretive than other bears. As sows leave second year cubs at the end of spring season, cubs become legal to hunters. Therefore, the proportion of females in the harvest increases during fall.

Mean skull sizes of male and female brown bears remained unchanged the past two seasons and are similar to the past nine seasons (Table 3). Average ages of male bears in the past two seasons are similar to past years. The average female age declined to a nine-season low of 3.4 years during 1993-94.

Permit Hunts. Registration permits were first implemented in Unit 1 during fall 1989 (Table 4). Although compliance with the registration permits was low during the first season, compliance in subsequent seasons has proven excellent.

About 47% of hunters who obtained permits during the past two seasons did not hunt (Table 4). Of the 294 people who hunted, 20% were successful. This is similar to the 14-21% success reported during 1990-92 (Larsen 1993).

Hunter Residency and Success. During the past two seasons, Unit 1 residents took half the unit's brown bear harvest (Table 5). The 45% nonresident harvest reported during 1992-93 was the highest over the past nine seasons. Nonresident harvest is limited in part to numbers of available guides. It is uncertain what affect the state's newly developed guide/outfitter regulations will have on nonresident brown bear harvests. After three seasons of minimal harvests by non-local Alaska residents, this group accounted for 21% of the 1993-94 harvest.

Harvest Chronology. The annual brown bear harvest for the past nine seasons has been about evenly split between fall and spring seasons (Table 6). Most of the brown bears harvested from Unit 1 are taken during May (Table 7). September has consistently been the second highest harvest month and has accounted for the majority of fall-harvested bears.

Transport Methods. As in the past, most Unit 1 brown bear hunters accessed hunting areas using boats (Table 8). Airplanes and off-road vehicles were used more by hunters during 1992-93 than during any of the past nine seasons.

Habitat Assessment. Timber harvest and mineral exploration and development continue to pose the most serious threats to brown bear habitat. Although this has been especially true in Subunits 1B and 1C, future timber harvest scheduled on the Cleveland Peninsula in Subunit 1A will affect brown bear habitat. Bear-human interactions and conflicts from increased access and development remain a concern. The likelihood of DLP kills continues as newly established logging and mining camps create garbage dumps that attract bears.

CONCLUSIONS AND RECOMMENDATIONS

The registration permit system implemented in 1989 continues to provide complete and useful information about brown bear hunter effort and success in Unit 1. The 3:2 male-to-female harvest

ratio was achieved each of the past two seasons and eight of the past nine seasons. Similarly, ages of harvested males have averaged above our objective of 6.5 years.

Four DLP kills were reported during 1992-93. This was the second time in four years we received this many DLP reports. As in the past, all came from Subunit 1D. Residential garbage was associated with one or two of the incidents. This is lower than the four reported during the 1990-91 report period; we achieved our objective of reducing the number of bears killed by garbage habituation. Domestic chickens were reported to have attracted one bear killed while attempting to break into the chicken coop.

Based on harvest data, incidental observations, and reports by the public and our staff, we consider the Unit 1 brown bear population stable. We see no reason to modify seasons or bag limits at this time.

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Table 1. Unit 1 brown bear harvests by subunit[a], 1985-1993.

Regulatory Year	Subunit 1A Harvest	1A % of Total	1B Harvest	1B % of Total	1C Harvest	1C % of Total	1D Harvest	1D % of Total	Total Harvest
1985	1	(4)	7	(30)	6	(26)	9	(39)	23
1986	2	(13)	2	(13)	5	(33)	6	(40)	15
1987	8	(24)	4	(12)	3	(9)	18	(55)	33
1988	4	(25)	2	(12)	3	(19)	7	(44)	16
1989	4	(20)	4	(20)	1	(5)	11	(55)	20
1990	5	(19)	5	(18)	4	(15)	13	(48)	27
1991	4	(15)	6	(24)	4	(15)	12	(46)	26
1992	7	(19)	8	(21)	4	(11)	18	(49)	37
1993	4	(17)	3	(12)	6	(25)	11	(46)	24
Totals	39	(18)	41	(18)	36	(16)	105	(48)	221

[a] Does not include DLP kills, research mortalities, or other human-caused accidental mortalities.

Table 2. Unit 1 brown bear harvest, 1985-1994

Regulatory Year	Reported							Estimated kill	Total estimated kill			
	Hunter kill				Non-hunting kill[a]			Unreported Illegal[b]				
	M (%)	F (%)	Unk.	Total	M	F	Unk.		M (%)	F (%)	Unk.	Total
Fall 1985	(30)	(70)	1	11	3	0	0	1	(46)	(54)	2	15
Spring 1986	(82)	(18)	1	12	1	0	0	1	(83)	(17)	2	14
Total	(57)	(43)	2	23	4	0	0	2	(64)	(36)	4	29
Fall 1986	(40)	(60)	0	10	0	0	0	1	(40)	(60)	1	11
Spring 1987	(80)	(20)	0	5	0	0	0	1	(80)	(20)	1	6
Total	(53)	(47)	0	15	0	0	0	2	(53)	(47)	2	17
Fall 1987	(73)	(27)	2	17	0	0	0	2	(73)	(27)	4	19
Spring 1988	(53)	(47)	1	16	1	0	0	1	(56)	(44)	2	18
Total	(63)	(37)	3	33	1	0	0	3	(67)	(33)	6	37
Fall 1988	(60)	(40)	0	5	1	1	0	1	(67)	(33)	1	8
Spring 1989	(82)	(18)	0	11	0	0	0	1	(82)	(18)	1	12
Total	(75)	(25)	0	16	1	1	0	2	(72)	(28)	2	20

Table 2. Cont

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

Table 2. Cont

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

[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.
[d] One female illegally killed at Fish Creek near Hyder, AK.
[e] Includes one male illegally killed at a Subunit 1D black bear bait station, and one Subunit 1C female killed by a hunter who failed to obtain a registration permit.

Table 3. Ages and skull sizes of brown bears harvested in Unit 1, 1985-1993.

Regulatory Year	Mean Skull Size[a]				Mean Age[b]			
	Male	*n*	Female	*n*	Male	*n*	Female	*n*
1985	22.3	12	20.5	8	9.1	11	6.5	8
1986	23.2	7	20.7	7	9.4	7	10.2	7
1987	21.4	18	20.6	11	5.5	17	7.7	7
1988	22.7	12	19.4	4	8.4	11	5.2	3
1989	21.2	14	20.6	5	6.7	13	7.4	5
1990	21.5	22	18.7	5	7.9	20	5.2	5
1991	21.6	13	20.4	8	7.4	14	7.9	6
1992	21.9	24	20.0	13	7.4	24	7.4	14[c]
1993	21.9	16	20.3	6	6.4	16	3.4	5

[a] Skull size equals length plus zygomatic width.
[b] Determined through analyses of extracted premolar teeth.
[c] Includes one Subunit 1C female taken illegally by a hunter without a registration permit.

Table 4. Unit 1 brown bear registration permit data, 1989- 1994

Season/ Hunt No.	Calendar Year	Permits issued	Percent did not hunt	Percent Unsuccessful Hunters	Percent successful hunters	Bear Harvest			
						Males (%)	Females (%)	Unk.	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[b]	135	(58)	(33)	(9)	(46)	(54)	0	13
(Spring)									
278S	1990	60	(0)	(88)	(12)	(71)	(29)	0	7
278S	1991	59	(0)	(86)	(14)	(100)	(0)	0	9
272S	1992[c]	142	(49)	(41)	(10)	(79)	(21)	0	14
272S	1993[c]	131	(43)	(48)	(9)	(91)	(9)	0	11
272S	1994[c]	133	(50)	(42)	(8)	(75)	(25)	0	12
Totals	1989-90	104	(0)	(91)	(9)	(67)	(33)	0	9[d]
	1990-91	126	(0)	(79)	(21)	(81)	(19)	0	27
	1991-92	324	(48)	(45)	(7)	(65)	(35)	0	26

Table 4. Continued

Season/ Hunt No.	Calendar Year	Permits issued	Percent did not hunt	Percent Unsuccessful Hunters	Percent successful hunters	Bear Harvest			
						Males (%)	Females (%)	Unk.	Total
	1992-93	280	(44)	(43)	(13)	(64)	(36)	0	36
	1993-94	279	(51)	(41)	(8)	(75)	(25)	0	24

[a] First season permits required.
[b] Seven hunters did not return permits.
[c] One hunter did not return permit.
[d] Only 45% of successful hunters obtained registration permits.

Table 5. Residency of successful brown bear hunters, Unit 1, 1985-1993.

Regulatory Year	Local resident[a] (%)	Nonlocal resident (%)	Nonresident (%)	Unk.	Total successful hunters
1985	(61)	(26)	(13)	0	23
1986	(60)	(27)	(13)	0	15
1987	(58)	(27)	(12)	3	33
1988	(56)	(19)	(25)	0	16
1989[b]	(45)	(25)	(30)	0	20
1990	(63)	(7)	(26)	1	27
1991	(65)	(4)	(23)	2	26
1992	(47)	(8)	(45)	1	37
1993	(54)	(21)	(25)	0	24

[a] Local residents are those hunters who reside in Unit 1.
[b] Before 1989 harvest data were obtained solely from sealing records.

Table 6. Seasonal chronology of brown bear harvest, Unit 1, 1985-1993.

Year	Fall		Spring	
	Harvest	Percent of Total	Harvest	Percent of Total
1985	12	(52)	11	(48)
1986	5	(33)	10	(67)
1987	16	(48)	17	(52)
1988	11	(69)	5	(31)
1989	10	(50)	10	(50)
1990	18	(67)	9	(33)
1991	12	(46)	14	(54)
1992	25	(68)	12	(32)
1993	12	(50)	12	(50)
Totals	121	(55)	100	(45)

Table 7. Monthly Unit 1 brown bear harvest chronology, 1985-1993.

Regulatory Year	Harvest Periods							*n*
	September	October	November	March	April	May	June	
1985	6	4	1	0	0	12	0	23
1986	6	2	2	0	1	4	0	15
1987	9	4	4	0	0	15	1	33
1988	2	2	1	0	0	10	1	16
1989	2	7	1	0	0	10	0	20
1990	9	8	1	0	1	8	0	27
1991	8	2	2	1	0	13	0	26
1992	14	10	1	0	3	9	0	37
1993	6	5	1	0	1	11	0	24
Totals	62	44	14	1	6	92	2	221

Table 8. Successful brown bear hunter transport methods, Unit 1, 1985-1993.

Regulatory Year	Percent of harvest						*n*
	Airplane	Boat	Walk	ORV	Highway vehicle	Other/ unknown	
1985	(4)	(61)	(4)	(9)	(13)	(9)	23
1986	(7)	(53)	(0)	(13)	(27)	(0)	15
1987	(12)	(52)	(9)	(12)	(6)	(9)	33
1988	(6)	(63)	(6)	(6)	(13)	(6)	16
1989	(10)	(70)	(5)	(5)	(5)	(5)	20
1990	(15)	(52)	(7)	(15)	(4)	(7)	27
1991	(8)	(62)	(0)	(8)	(3)	(19)	26
1992	(17)	(50)	(0)	(3)	(30)	(0)	37
1993	(0)	(71)	(4)	(0)	(25)	(0)	24

LOCATION

Game Management Unit: Unit 4 (5,800 mi^2)

Geographical Description: Admiralty, Baranof, Chichagof, and adjacent islands

BACKGROUND

Brown bears inhabit the major islands in Unit 4: Admiralty, Baranof, Chichagof, Kruzof, Yakobi and Catherine. Most bear habitat is included in the Tongass National Forest and managed under a multiple use plan by the U.S. Forest Service (USFS). On both USFS and private lands, commercial logging has altered extensive habitat. Admiralty Island has the largest area of uncut old-growth forest since being designated a National Monument and managed under wilderness guidelines. Elsewhere in the unit, logging will help determine brown bear density and distribution.

This unit 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 since 1990 (Miller 1993*b*). Federal assumption of subsistence management under the terms of ANILCA included authority for brown bears on federal lands. Dual authority with the state of Alaska has created a difference in regulations and may preclude future use of management options available in other areas.

Brown bear viewing is also important to Southeast Alaska. 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 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 and property (DLP).

METHODS

Registration permits were issued at Alaska Department of Fish & Game (ADF&G) offices for Unit 4 brown bear hunting. Successful bear hunters presented skulls and hides for sealing to a representative of the Division of Wildlife Conservation (DWC). Bear sealers measured the skull, extracted a premolar, determined sex, and recorded data on the kill date and location, hunter residency, hunt length, guide services, and primary transportation. Cementum annuli of teeth were counted at a commercial laboratory.
Data recorded on sealing forms and registration permit reports were entered into a computer data storage and retrieval program. Delinquent permittees were sent reminder letters and certified letters to improve reporting compliance. Permittees who failed to respond were cited to court by the Alaska Department of Public Safety.

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

DWC staff and USFS personnel contacted visitors at the Seymour Canal Closed Area, better known as Pack Creek. 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 Pack Creek Cooperative Management Area regulations.

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. Current harvest levels on southern Admiralty Island and Northeast Chichagof Island warrant close scrutiny. The Brown Bear Management Areas (BBMA's) developed by Young (1990) have proven useful for monitoring harvest patterns but do not contain valid subpopulations for management purposes. Continued expansion of logging roads, particularly on Northeast Chichagof Island, has created increased vulnerability of bears to hunters. These roads increase access to salmon streams, bays, and estuaries, resulting in high bear harvest (Young 1989, 1990; Titus and Beier 1992).

Population Size: Early estimates based on track counts (Dufresne and Williams 1932; Holbrook 1938, 1939) undoubtedly underestimated brown bear numbers. Titus and Beier (1993) reported bear densities on Admiralty and Northeast Chichagof islands study areas. These studies provide the basis for population estimates for major areas of the unit. Miller (1993*a*) provided estimates of 1,660 bears on Admiralty, 816 on Baranof, 1,625 on Chichagof, and 127 on Kruzof islands. His minimum and maximum estimates for the unit were 3,835 and 4,642 bears.

Population Composition: Data are lacking on the population composition of free- ranging bears. Research programs produce small sample sizes and due to capture bias do not represent the sexes

and age classes of bears in the population. Age and sex data from hunter harvest also are biased. Factors known to favor the dominance of males in the sealing data are: 1) regulations protect sows accompanied by cubs, 2) hunter selection for larger bears, 3) male vulnerability due to the use of beaches in early spring, and 4) misidentification of harvested bears by sealers.

In Unit 4 the 1992-93 legal harvest was 69% males (n = 85) and 31% females (n = 38). The 1993-94 harvest was 65% males (n = 67), 35% females (n = 35), and one bear of unknown sex. Table 1 displays sex information for the last five regulatory years.

Mortality

Harvest:

Season and Bag Limit	Resident and nonresident hunters
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	Sept. 15-Dec.31 Mar. 15-May 31
One bear every 4 regulatory years by registration permit only	
That portion in the Northeast Chichagof Controlled Use Area	Mar. 15-May 20
One bear every 4 regulatory years by registration permit only	
Remainder of Unit 4	Sept. 15-Dec. 31 Mar. 15-May 20

One bear every 4 regulatory years
by registration permit only

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

Human-induced Mortality. Regulatory Year 1992-93: Hunters took 31 brown bears in fall 1992 and 92 in spring 1993. The total was 123 bears. This compares to a kill of 124 bears in 1991-92.

Regulatory Year 1993-94: Hunters took 28 bears in fall 1993 and 74 in spring 1994. The total for the year was 103 bears. Brown bear harvests for the past five years are presented in Table 1.

The harvest distribution by island in 1992-93 was: Kruzof, 3 (2%); Admiralty, 57 (44%); Baranof, 17 (13%); and 54 (41%) from Chichagof. In regulatory year 1993-94 the take by island was: 48 bears (37%) from Admiralty, 19 (18%) from Baranof, and 40 (37%) from Chichagof.

In 1992-93, Admiralty (1,660 mi^2) had a harvest rate of 1bear/29 mi^2, while on Chichagof (2,100 mi^2) the average kill was 1bear/39 mi^2. Baranof (1,600 mi^2) showed a kill of 1 bear/94 mi^2. Similar data for 1993-94 are: Admiralty Island, 1 bear/35 mi^2; Chichagof,1 bear/53 mi^2; and Baranof,1 bear/84 mi^2.

The mean age of hunter-killed females was 7.1 years (n = 36) in 1992-93, while males averaged 7.5 years (n = 84). In 1993-94 the mean age of females was 7.1 years (n = 34) and males averaged 8.5 years (n = 67). The average male skull measurement was 21.4 inches (n = 87) in 1992-93 and 22.2 inches (n = 3) in 1993-94. The long-term trends in skull measurements closely match those found in the age data.

Harvest data variation can create problems when making short-term management decisions. Miller and Miller (1990) cautioned that age and sex data derived from harvest are difficult to interpret yet useful as indicators of long-term trends. For the larger islands, long-term trends in sex, age, and skull measurements are stable within established parameters.

Hunter Residency and Success. Unit 4 is managed as 3 registration permit hunt areas: outside drainages, inside drainages, and the Northeast Chichagof Controlled Use Area (NECCUA) (Table 2). In fall 1992-93 30 permittees reported hunting and killing 8 bears (27% success) in the outside drainages; in the spring 37 permittees hunted and took 9 bears (24%). In fall 1993-94 34 permittees hunted and killed 9 bears (26%); in the spring season 27 permittees killed 9 bears (33%).

In fall 1992-93 88 permittees took 23 bears (26%) from the inside drainages; 148 permittees killed 65 bears (44%) in the spring. In fall 1993-94 64 permittees took 19 bears (30%); 131 permittees killed 58 bears (44%) in the spring.

NECCUA has only spring seasons. In 1992-93 46 permittees took 18 bears (39%); in 1993-94 31 hunters killed 8 bears (26%).

Local residents of Unit 4 continue to take the smallest percentage of bears (Table 3). Most bears were taken by nonresidents and Alaska residents from other areas of the state. In 1992-93 nonlocal Alaska hunters and nonresidents composed 79% of those who hunted, taking 93% of the bears. In 1993-94 78% of the hunters were nonresidents and nonlocal Alaskans, taking 89% of the bears. Although 22% of the hunters during the past two years lived in Unit 4, they took only 9% of the harvest (1bear/6.9 hunters). Nonlocal Alaskans composed 37% of hunters who took 28% of the bears (1 bear/3.8 hunters). Nonresidents composed 41% of the hunters and took 63% of the bears (1 bear/1.8 hunters).

In fall 1992 81 Alaska residents hunted 333 days, while 37 nonresidents spent 182 days afield. In fall 1993 58 residents hunted 248 days; 40 nonresidents hunted 269 days. Spring seasons produce a larger harvest (Table 1) and witness greater hunting pressure (Table 4). In spring 1993 135 residents hunted 630 days and 95 nonresidents hunted 539 days. In spring 1994 99 residents hunted 503 days and 90 nonresidents hunted 542 days. Fall seasons produced 1 bear for every 17-18 hunt days; spring seasons produced 1 bear for every 13-14 days. (Table 4).

Harvest Chronology. Most fall harvest occurs during the first two weeks of the season (Table 5). The greatest hunting pressure is 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.

The percentage of male bears killed in spring seasons is higher than in the fall, but the actual number of females killed is frequently greater (Table 1). The greatest number of bears are available to hunters in May when nearly all bears have left their dens and are seeking food; most spring bears are killed late in the season (Table 5). Spring reduces hunter success as bears spend less time in open areas where they are most vulnerable.

Transport Methods. Boats are the most common form of transportation used by bear hunters in Unit 4 (Table 6). In 1992-93 81% of successful hunters used boats. In 1993-94 successful hunters used boats 84% of the time. Aircraft are the second most important means of hunter transport but were used by only 10% and 7% of the hunters in 1992-93 and 1993-94 seasons, respectively.

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

In 1992-93, 8 nonhunting mortalities were reported (Table 1); 4 occurred in 1993-94. Six were on Northeast Chichagof Island, all in established communities or logging camps. The 4 bears killed on Admiralty Island came from the northern tip of the island closest to Juneau and with an active mining development. Two bears were killed away from human developments, 1 each on Baranof and Kruzof islands.

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, are thought to make extensive movements from their mothers' home range. The importance of subadult dispersal in maintaining viable brown bear populations is poorly understood.

Bear Viewing. In 1981, the first year records were kept, 130 people visited Pack Creek to view bears. Permits were first required for use of the Pack Creek Cooperative Management Area in the early 1990s. Public interest has been steadily increasing, and in summer 1992 1,176 people visited the Stan Price Wildlife Sanctuary to view brown bears. In 1993 the number of visitors was 1,099.

CONCLUSIONS AND RECOMMENDATIONS

We met management objectives for harvested male brown bear ages in both years. The average age for the 1992-92 regulatory year was 7.5 years and 8.5 in 1993-94; both exceed the 6.5 year minimum objective. The male/female harvest ratio was 3:1.3 in 1992-93 and 3:1.6 in 1993-94.

The third objective of 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 contributing to such losses.

I recommended that Admiralty Island, Chichagof-Yacobi islands, and Baranof-Kruzof islands be managed as 3 discrete subpopulations. Human pressures on brown bears in the unit requires the use of all available information concerning the population status for management actions. I believe none of these "island subpopulations" is experiencing excessive human-induced mortality. Evaluation of harvest from small areas will be included in decisions made to maintain the viability of islandwide brown bear subpopulations. Brown bear movement patterns are not understood enough to identify small subpopulations for management purposes.

The northeast Chichagof Island harvest remains a concern because new logging road construction north of Port Frederick will probably generate excessive harvest, similar to NECCUA. NECCUA boundaries should be extended to include this area. Access and season restrictions on the remainder of Chichagof Island are not necessary as the road system is limited.

Southern Admiralty Island bear harvest is a concern to some members of the public. Using only the extreme south Admiralty area, a conservative population estimate, and the lowest harvest guideline, the public may have a case for excessive harvest. However, the area does not contain a self-sustained subpopulation of bears. Given the area's long history of high sustained harvest, it follows that the harvest draws upon bears from a larger geographical area. The area contains an undetermined number of bears that also utilize adjoining BBMA's. Using more liberal population estimates and/or harvest guidelines, recent harvests do not indicate a need for more conservative

regulations. Combining the estimated subpopulation and bear harvest in the 3 BBMA's that comprise south Admiralty, I do not find recent harvests excessive. Southern Admiralty will remain a focal area for management attention.

ACKNOWLEDGMENTS

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Table 1. Unit 4 brown bear harvest, 1989-1994

Regulatory	Hunter kill					Nonhunting kill[a]				
Year	M	F	(%F)	Unk.	Total	M	F	Unk.	Total	Total reported
1989										
Fall 89	18	12	(40)							
Spring 90	73	17	(19)							
Total	91	29	(24)	1	121	1	3	0	4	125
Fall 90	20	13	(39)							
Spring 91	78	208	(20)							
Total	98	33	(25)	1	132	3	1	2	6	138
1991										
Fall 91	15	25	(63)							
Spring 92	67	16	(19)	0						
Total	82	41	(33)	1	124	6	5		11	135
Fall 92	17	14	(45)							
Spring 93	68	24	(26)							
Total	85	38	(31)	0	123	6	1	1	8	131
1993										
Fall 93	15	13	(46)							
Spring 94	52	22	(30)	1						
Total	67	35	(34)	1	103	3	1	0	4	107

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

[b] Permit hunt harvest is included.

Table 2. Unit 4 brown bear harvest data by permit hunt, 1989/90-1993/94.

Hunt No. /Season	Regulatory year	Permits issued[a]	Did not hunt (%)	Unsuccessful hunters (%)	Successful hunters (%)	M (%)[b]	F (%)	Unk.	(%)[c]	Total harvest
NECCUA										
S	1989/90	66	44 (67)	19 (91)	2 (9)	1 (50)	1 (50)	0	(0)	2
S	1990/91	72	37 (51)	21 (60)	14 (40)	12 (86)	2 (14)	0	(0)	14
S	1991/92	92	57 (62)	29 (83)	6 (17)	3 (50)	3 (50)	0	(0)	6
S	1992/93	101	55 (54)	28 (61)	18 (39)	9 (50)	9 (50)	0	(0)	19
S	1993/94	68	37 (54)	23 (74)	8 (26)	7 (88)	1 (13)	0	(0)	8
Inside Drainages										
F	1989/90	181		48 (68)	23 (32)	12 (52)	11 (48)	1	(1)	24
S	1989/90	241		95 (54)	80 (46)	65 (81)	15 (19)	0	(0)	80
F	1990/91	279		68 (72)	27 (28)	17 (63)	10 (37)	0	(0)	27
S	1990/91	353		105 (62)	65 (38)	51 (80)	13 (20)	1	(2)	65
F	1991/92	268		65 (66)	33 (34)	13 (41)	19 (59)	1	(<1)	33
S	1991/92	284		104 (62)	64 (38)	55 (86)	9 (14)	0	(0)	64
F	1992/93	341		65 (74)	23 (26)	11 (48)	12 (52)	0	(0)	23
S	1992/93	393		83 (56)	65 (44)	50 (77)	15 (23)	0	(0)	65
F	1993/94	290		45 (70)	19 (30)	9 (47)	10 (53)	0	(0)	19
S	1993/94	312		73 (56)	58 (44)	38 (66)	20 (34)	0	(0)	58
Outside Drainages										
F	1989/90	164		16 (70)	7 (30)	6 (86)	1 (14)	0	(0)	74
S	1989/90	105		31 (80)	8 (20)	7 (88)	1 (12)	0	(0)	8
F	1990/91	221		29 (83)	6 (17)	3 (50)	3 (50)	0	(0)	6
S	1990/91	353		12 (38)	20 (62)	15 (75)	5 (25)	0	(0)	20
F	1991/92	268		28 (78)	8 (22)	2 (25)	6 (75)	0	(0)	8
S	1991/92	284		34 (72)	13 (28)	9 (69)	4 (31)	0	(0)	13
F	1992/93	341		22 (73)	8 (27)	5 (63)	3 (38)	0	(0)	8
S	1992/93	393		28 (76)	9 (24)	9 (100)	0 (0)	0	(0)	9
F	1993/94	290		25 (74)	9 (26)	6 (67)	3 (33)	0	(0)	9
S	1993/94	312		18 (67)	9 (33)	7 (78)	2 (22)	0	(0)	9

[a] Number of permits issued from 1990/91 to present are identical for the inside and outside permit areas because a single permit was valid for both areas.

[b] Percentage based on known sex bears.

[c] Percentage based on total bears.

Table 3. Unit 4 brown bear successful hunter residency, 1989- 94

Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total successful hunters
1989/90	15	(12)	40	(33)	66	(55)	121
1990/91	17	(13)	41	(31)	74	(55)	132
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

[a] Resident of Unit 4.

Table 4. Hunting effort by residency in Unit 4, fall 1990-spring 1994.

Hunt	Season	No. resident hunters	No. nonresident hunters	Total hunters	Days hunted by residents	Days hunted by nonresidents	No. days hunted	No. bears killed	Days effort per bear
NECCUA									
	Spring 1991	19	16	35	69	72	141	14	10
	Spring 1992	21	14	35	77	95	172	6	29
	Spring 1993	29	17	46	113	96	229	18	13
	Spring 1994	11	20	31	43	111	154	8	19
outside drainages									
	Fall 1990	32	4	36	99	19	118	7	17
	Spring 1991	19	13	32	63	59	122	20	6
	Fall 1991	33	3	36	103	18	121	8	15
	Spring 1992	23	24	47	62	140	202	13	16
	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
inside drainages									
	Fall 1990	54	40	94	292	228	520	27	19
	Spring 1991	116	54	170	620	256	876	65	14
	Fall 1991	57	41	98	273	262	535	33	16
	Spring 1992	105	63	168	513	353	866	64	14
	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

Table 4. Continued

Hunt	Season	No. resident hunters	No. nonresident hunters	Total hunters	Days hunted by residents	Days hunted by nonresidents	No. days hunted	No. bears killed	Days effort per bear
Unit 4									
Totals	Fall 1990	86	44	130	391	247	638	34	19
	Spring 1991	154	83	237	752	387	1,139	99	12
	Fall 1991	90	44	134	376	280	656	41	16
	Spring 1992	149	101	250	652	588	1,240	83	15
	Fall 1992	81	37	118	333	182	515	31	17
	Spring 1993	136	95	231	630	539	1,169	92	13
	Fall 1993	58	40	98	248	269	517	28	18
	Spring 1994	99	90	189	503	542	1,045	75	14

Table 5. Unit 4 brown bear harvest chronology, 1989-93[a].

Regulatory year	Harvest period: September 9/11-9/20	9/21-9/30	October 10/1-10/10	10/11-10/20	10/21-10/31	November 11/1-11/10	11/11-11/20	11/21-11/31	December 12/1-12/10	12/11-12/20	12/21-12/31
1989/90	14	7	7	1	2	0	0	0	0	0	0
1990/91	18	5	5	3	0	2	0	0	0	0	0
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

Regulatory year	Harvest period: April 4/1-4/10	4/11-4/20	4/21-4/30	May 5/1-5/10	5/11-5/20	5/21-5/31	*n*
1989/90	1	0	3	26	55	5	121
1990/91	1	1	6	22	58	11	132
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

[a] Includes all hunts.

Table 6. Unit 4 brown bear harvest by transport method, 1989/90-1993/94[a].

Regulatory year	Harvest						
	Airplane	Boat	3-or 4-wheeler	Walked	ORV	Highway vehicle	Unknown
1989/90	15	106					
1990/91	17	111		2		2	
1991/92	11	108			1	2	2
1992/93	13	104		3		3	
1993/94	8	89		2		4	

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

LOCATION

Game Management Unit: 5 (6,200 mi^2)

Geographical Description: Cape Fairweather to Icy Bay, Eastern Gulf Coast

BACKGROUND

Brown bears probably first inhabited 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/Tatsenshini corridor.

Since 1961 when brown bears were first sealed in Alaska, 745 sport-killed bears have been sealed from Unit 5 (640 from Subunit 5A and 105 from 5B). Sixty-four percent of these bears were males, and 61% were taken by nonresident hunters. An additional 57 nonsport bears have been taken in the same period.

A 1988 Superior Court decision which 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 1988, the number has climbed to 28.

MANAGEMENT DIRECTION

Management Objectives

Brown bear population objectives identified by staff include maintaining a male:female harvest ratio of no less than 3:2 and an average age of harvested males of no less than 6.5 years. We will 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 and Fish and Game 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 rudimentary premolar tooth is extracted for age determination. Additional information is from the hunter, such as harvest location, transportation method, number of days hunted, and guide information. Other information collected includes incidental observations of bear dens noted during mountain goat aerial surveys and anecdotal 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 the population is probably stable. However, the highest kill on record was in 1991, and the harvest in 1992 was only one animal less. During 1993, the second year of the report period, the harvest declined to 30 bears, closer to the long-term average. No consistent trends in either male skull size or age of bears harvested has been evident.

Mortality

Season and Bag Limit:	Resident and nonresident hunters
Unit 5	Sept. 1-May 31
One bear every four regulatory years	

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

Human-induced Mortality: Unit 5 brown bear harvests have increased. The average kill from 1971-80 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 37 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 this decade (1990's average is 5.6 years). Average male skull size has leveled off (1990's average is 22.5 inches) after increasing between the two earlier decades (1970's average was 20.1 inches; 1980's average was 22.6 inches).

During the 1992 season 28 males and 11 females were taken legally, with one additional female killed illegally. Females composed 30% of the total harvest. Average male skull size was similar to the five-year average found between 1987 and 1992. The average age of male bears was a full year below our management objective.

In 1993 19 males and 11 females were killed, with no illegal or DLP kills reported. Females composed 37% of the harvest. Mean male skull size was the largest on record, and the average age of male bears rebounded from the previous year above our management objective. The reasons for these increases are unknown, although they accompanied the decrease in harvest from the previous two seasons. Since there is not a registration permit required in this area, we do not know if fewer hunters pursued bears or success levels dropped. One possibility is that hunters were more selective and targeted older bears.

Hunter Residency and Success: From 1987 to 1991 the number of brown bears taken in Unit 5 by nonresident hunters ranged from 22 to 33 bears (mean = 26), representing 65-80% of the kill

(mean = 77%). In 1992 nonresidents took 29 (73%) of the sport harvest, compared with 21 bears (70%) in 1993.

Harvest Chronology: From 1987-91 the average proportion of brown bears taken in spring was 41%. In 1992 14 of 40 sport kills (35%) were in spring. In 1993 18 of the 30 sport kills (60%) occurred in spring.

Transport Methods: Transportation types used in successful 1992 hunts included aircraft (55%), boats (25%), highway vehicles (10%), and foot (8%). In 1993 hunts aircraft were used in 63% of successful brown bear hunts, while the use of boats held steady at 23%. Hunts on foot accounted for the remaining 10%, although most of those probably involved the use of a highway vehicle.

CONCLUSIONS AND RECOMMENDATIONS

Unit 5 brown bear age objectives were not met the first year of the report period. The mean age of male bears (5.0) fell more than one year below the objective of 6.5 years (Table 1). The male:female ratio of 4.7:2 exceeded our goal. In 1993 both objectives were met, with the mean age of male bears climbing to 6.7 years and the sex ratio of the harvest to 3.5:2.

The 1992 Unit 5 brown bear harvest of 40 was only one short of the record number killed in 1991. The effects of having successive record-level harvests are not clear. While skull size did not decrease, the average bear age did, indicating hunters were taking more young animals. When the 1993 harvest fell to the lowest level in five years, average skull size of male bears increased to the largest value since sealing began. With no population information available, it will be important to monitor the few indicators we have, such as the age and sex ratio of the harvest. If the low harvest of 1993 is an anomaly and the trend towards higher hunting mortality resumes, a more conservative approach to hunting brown bears in Unit 5 may be necessary. This approach will be more important if federal subsistence hunting regulations stimulate additional harvest. If low harvests persist with a dearth of bears in the younger age classes, we may be dealing with weak or failed age classes which could have management implications. Implementation of a registration permit would allow us to assess hunter effort and success.

When black and brown bears are near residences in Yakutat, village residents view them as pests. The Yakutat dump has attracted 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, and skull sizes, 1986-1993.

	Harvest				Mean Age			Mean Skull Size		Avg. Days/Kill	
Year	M	F	Unk	Total	M	F	Total	M	F	M	F
1986	19	10	0	29	7.6	5.6	6.9	23.4	20.5	4.0	7.0
1987	21	14	0	35	7.0	6.8	6.9	22.8	20.9	4.4	4.8
1988	15	14	0	29	5.4	4.2	4.8	21.4	20.7	3.6	3.5
1989	15	10	0	25	6.4	3.8	5.4	23.2	19.7	4.0	3.1
1990	25	8	2	35	8.3	4.9	7.4	22.3	23.0	5.0	4.0
1991	33	8	0	41	6.0	5.4	5.9	21.9	22.4	5.4	4.3
1992	28	12	0	40	5.0	5.5	5.2	22.2	20.3	4.3	3.8
1993	19	11	0	30	6.7	6.7	6.7	25.3	21.3	3.2	5.6
Mean	21.9	10.9	0.3	33.0	6.55	5.4	6.2	22.8	21.1	4.2	4.5

LOCATION

Game Management Unit: 6 (10,140 mi^2)

Geographical Description: Prince William Sound and North Gulf Coast

BACKGROUND

Brown bears are in most of Unit 6, with the exception of Middleton Island and all islands in western Prince William Sound (PWS). Distribution of brown bears in PWS is unchanged from that observed by Heller (1910).

In 1961-62 we began monitoring harvest through mandatory sealing. 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). During 1987-88 through 1991-92, the average yearly harvest was 50 bears (range = 40-60). Most of the increased harvest was in PWS, resulting in a population decline in most of the eastern sound and on Hinchinbrook Island.

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 Subunits 6A, 6C 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 bear mortality (MacLellan 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

Using methods developed by Griese (1991), Miller (1988) and Grauvogel (1990), staff estimated the number of bears. I quantified the amount of habitat within major drainages and estimated the bear density in each major drainage. I calculated the number of bears by multiplying bear density times habitat area and by summing the results to obtain population estimates for the unit, subunits, and harvest areas within subunits. Bear habitat was defined as nonglaciated land below 3,000 feet.

Density estimates were based on local knowledge and previous estimates in Unit 6 (Griese 1991, Campbell and Griese 1987).

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

I estimated total harvest by adding reported harvest and estimated illegal kill. Data were summarized in 11 harvest areas, each with similar biogeographic and harvest characteristics. The reported harvest included all bears sealed after being taken by hunters or killed for other reasons, such as defense of life and property. Information collected included: skull size, sex, age, date of kill, number of days hunted, location of kill, method of transportation, and hunter residency. 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 739 bears (Table 1). The greatest number were in Subunit 6D (280), followed by Subunits 6A (255), 6C (106), and 6B (98). Bear numbers over the past 5 years did not change significantly in Subunits 6A, B and C. In Subunit 6D, the population declined by 46 bears (14%) because of excessive harvests. The greatest reduction was in the Rude River-Ellamar (27%) and Hinchinbrook Island (15%) areas.

The bear population on Montague Island in Subunit 6D was stable with 41 bears. The island is particularly sensitive to overharvest because it is isolated from the mainland and the number of bears is very low. Historically, it had much higher numbers. However, overharvest that began in the 1970s reduced the population to its current level (Griese 1990). Viability of this small population may now be threatened. 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 (Figure 1). Hinchinbrook Island was within a high density range (>175bears/1,000 sq km) that included Kodiak Island, much of the Alaska Penninsula, and parts of southeast Alaska. Montague Island, eastern PWS and the north gulf coast were mid-range density (10-175 bears/1,000 sq km), consistent with contiguous coastal habitat to the southeast and with the northern Alaska Peninsula. Bear density was low in western PWS (<40 bears/1,000 sq km), similar to the adjacent Kenai Penninsula.

Mortality

Harvest:

Season and Bag Limit. The hunting season for resident and nonresident hunters in Subunit 6A, B and C was 1 September to 30 May. The Subunit 6D season, except Montague Island, was 1 October to 30 May for all hunters. On Montague Island, the season for resident and nonresident hunters was 1 April to 15 May. The bag limit for the entire unit was 1 bear every 4 regulatory years. Taking cubs (bears $\leq$ 2-years-old) or females accompanied by cubs was prohibited.

Board of Game Actions. Effective regulatory year 1994-95, the Board shortened the Subunit 6D season (except Montague Island) to 15 October to 15 May. Montague Island was closed to hunting. These actions were in response to concern over low bear numbers on Montague Island and continuing overharvest in Subunit 6D. ADF&G proposed the changes with support from the general public and Fish and Game Advisory Committees in Cordova, Valdez and Anchorage.

Hunter Harvest. Reported kill during 1992-93 and 1993-94 for Unit 6 was 44 and 22, respectively (Table 1). Most were taken from Subunit 6D (26 in 1992-93 and 15 in 1993-94). Unitwide harvet was lower than during any of the previous 3 years. Kill was probably reduced in Subunit 6D by a change of the season opening date from 1 September to 1 October that began in 1992-93. Also, 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 showers.

During 1992-93 and 1993-94, males were 64% and 68% of the reported kill (Table 2), and mean skull sizes among males were 22 inches and 24 inches (Table 3), respectively. The proportion of males in the harvest during 1993-94 was the highest in the last 5 years. The cold spring 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 Van Daele et al. (1989) reported this chronology elsewhere in southcentral Alaska.

Reported kill was below annual allowable harvest (AAH) in most of Unit 6 during this reporting period (Table 1). Notable exceptions were the Rude River-Ellamar and Hinchinbrook Island portions of Subunit 6D. The Rude River-Ellamar harvest rate averaged 12.7% for all bears and 4.3% for females >2 years old. Hinchinbrook Island rates averaged 7.9% and 1.1%. Overharvests also occurred each of the previous 3 years in both areas, causing a decline in numbers.

AAH on Montague Island was 2 bears, which 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). A deer hunter was convicted of killing a bear on the island during fall 1992 and reporting it taken in Subunit 6B.

Hunter Residency. Nonresidents harvested most of the bears in Unit 6 during 1992-93 (45%) and 1993-94 (48%) (Table 4). In Subunits 6C and 6D, local residents and nonlocal residents of Alaska took higher proportions 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 (43% in 1992-93 and 57% in 1993-94) (Table 5). September and October were also important harvest periods. This pattern among subunits has not changed over the past 5 years.

Transport Methods. Airplanes were the most important method of transportation unitwide (Table 6). In Subunit 6C, 3- or 4-wheelers and highway vehicles were also important because of road access. In Subunit 6D boats were important, along with aircraft, because the relatively sheltered waters of PWS allow use of small boats. These patterns were typical of the past 5 years.

Other Mortality. Nonhunting and estimated illegal kill totaled 9 bears in 1992-93 and 6 bears in 1993-94 (Table 2). This was similar to previous years.

Nonregulatory Management Problems/Needs.Timber harvesting was in progress or planned in brown bear habitat in all subunits, except 6B. Logging on private land in Subunit 6D, Montague Island, and on the PWS mainland between Rude River and Ellamar was of particular concern.

On Montague Island, logging was begun in Patton Bay during summer 1993. Clearcutting was completed on 857 hectares. A haul road was constructed around the south end of the island to move logs from Patton Bay to a log transfer site in MacLeod Harbor. Important bear habitat was lost and bear-human interactions may result in increased bear mortalities. Estimated bear numbers on Montague Island were already low (41) and AAH was only 2 bears.

In the Rude River-Ellamar area, large clearcuts were completed near Two Moon Bay. Additional cutting began at Fish Bay during spring 1994, and logging operations are planned for Nelson and Simpson bays. Bear numbers may already be declining due to excessive hunter harvests, and as logging increases, access will improve, brown bear habitat quality will decline, and nonhunting mortality will increase.

CONCLUSIONS AND RECOMMENDATIONS

We achieved management objectives. 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 probably stable, and management strategies were appropriate in Subunits 6A, B, and C. I recommend no changes for those subunits. In Subunit 6D, numbers probably declined in the Rude River-Ellamar and Hinchinbrook Island areas due to overharvest. The Montague Island population was very low and cannot sustain any hunter harvest until

numbers increase. My recommendations for regulatory action to correct these problems were approved by the Board of Game and implemented in 1994-95. Montague Island was closed to hunting, and the season in the remainder of Subunit 6D was shortened to 15 October-15 May. These changes should ensure the continued viability of the Montague Island population and reduce harvest to sustainable levels (AAH=12 bears) in the remainder of the subunit. Careful harvest monitoring should continue, and a permit hunt should be considered in the remainder of Subunit 6D if AAH is not achieved.

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 quantified to assess effects on the bear population. Contractors should be monitored to assure operator compliance with guidelines for handling garbage and other attractants. We should continue education/enforcement actions as necessary.

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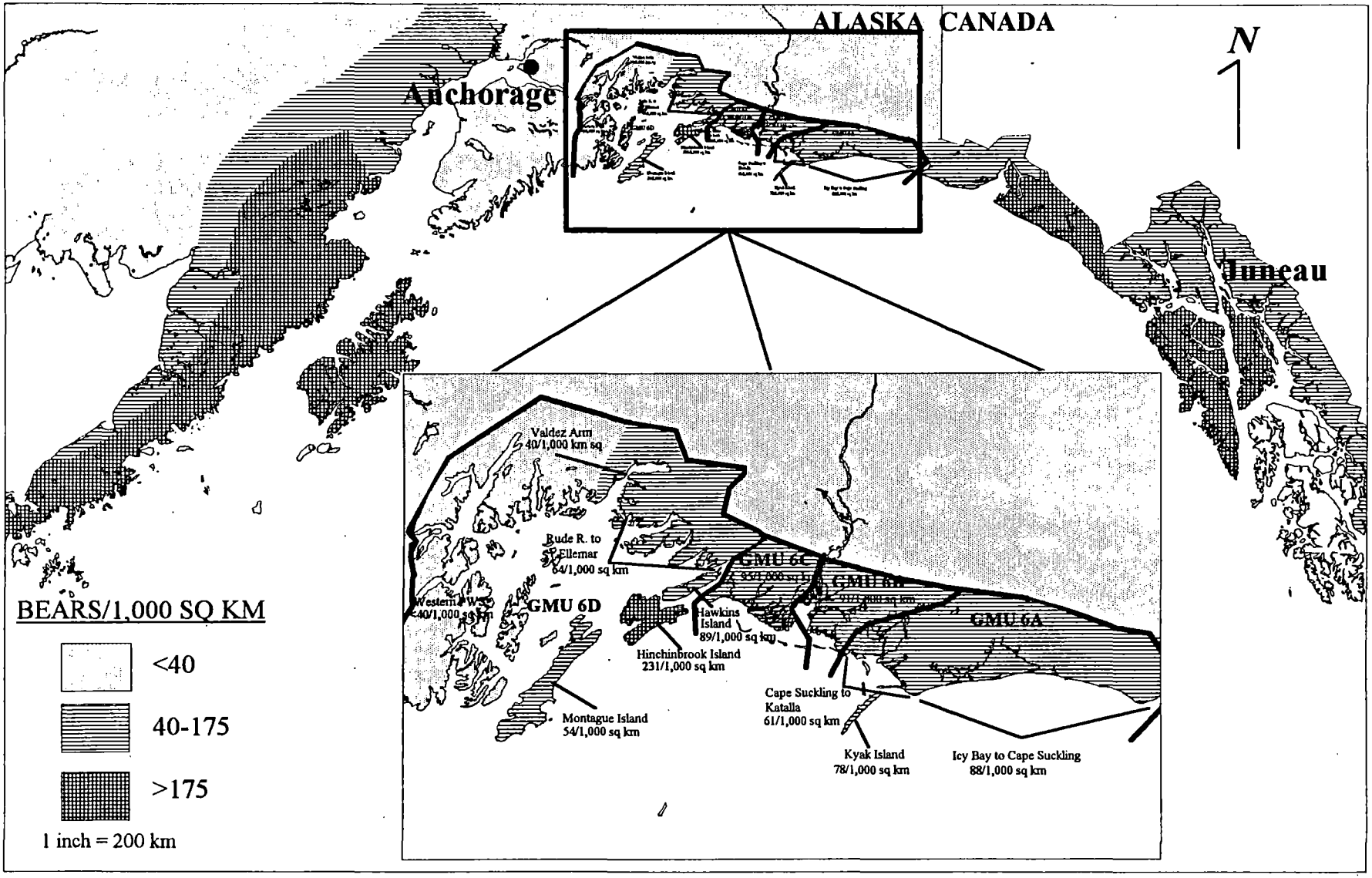

Figure 1. Probable distribution of high (>175 bears/1,000 sq km), intermediate (40-175) and low density (<40) brown bear habitats in south coastal Alaska (Miller 1993a) and in Unit 6.

Table 1. Unit 6 brown bear estimated population, annual allowable harvest, and reported harvest, 1989-94.

Subunit	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)
6A	Icy Bay-	1989/90	83	154	8	6	3	1
	Cape Suckling	1990/91	83	154	8	3	3	1
		1991/92	83	154	8	3	3	2
		1992/93	83	154	8	6	3	1
		1993/94	88	164	8	2	3	0
	Cape Suckling-	1989/90	60	83	4	8	2	2
	Katalla	1990/91	61	85	4	4	2	1
		1991/92	61	85	4	7	2	2
		1992/93	61	85	4	6	2	2
		1993/94	61	85	4	4	2	1
	Kayak Island	1989/90	72	6	0	0	0	0
		1990/91	78	7	0	0	0	0
		1991/92	78	7	0	0	0	0
		1992/93	78	7	0	0	0	0
		1993/94	78	7	0	0	0	0
6A Total		1989/90	73	243	12	14	5	3
		1990/91	74	245	12	7	5	2
		1991/92	74	245	12	10	5	4
		1992/93	74	245	12	12	5	3
		1993/94	77	255	13	6	5	1

Table 1. Continued.

Subunit	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)
6B		1989/90	94	101	5	4	2	2
		1990/91	94	102	5	9	2	4
		1991/92	94	102	5	8	2	3
		1992/93	91	98	5	4	2	0
		1993/94	91	98	5	1	2	1
6C		1989/90	90	100	5	5	2	1
		1990/91	91	101	5	2	2	0
		1991/92	91	101	5	8	2	2
		1992/93	95	106	5	2	2	0
		1993/94	95	106	5	0	2	0
6D	Rude River-Ellamar	1989/90	88	110	6	11	2	5
		1990/91	84	105	5	17	2	6
		1991/92	75	93	5	13	2	3
		1992/93	68	85	4	11	2	4
		1993/94	64	80	4	10	2	3
	Valdez Arm	1989/90	40	36	2	2	1	0
		1990/91	40	36	2	3	1	1
		1991/92	40	35	2	1	1	0
		1992/93	40	36	2	3	1	1
		1993/94	40	36	2	0	1	0

Table 1. Continued.

Subunit	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	Western PWS	1989/90	-	17	0	2	0	0
		1990/91	-	16	0	0	0	0
		1991/92	-	17	0	1	0	1
		1992/93	-	17	0	1	0	0
		1993/94	-	17	0	0	0	0
	Hinchinbrook Island	1989/90	271	108	5	8	2	2
		1990/91	263	105	5	12	2	5
		1991/92	246	98	5	7	2	2
		1992/93	241	96	5	10	2	2
		1993/94	231	92	5	5	2	0
	Hawkins Island Island	1989/90	89	15	1	0	0	0
		1990/91	95	16	1	1	0	0
		1991/92	95	16	1	2	0	0
		1992/93	89	15	1	0	0	0
		1993/94	89	15	1	0	0	0
6D Total Without Montague Island		1989/90	-	286	14	23	6	7
		1990/91	-	278	14	33	6	12
		1991/92	-	259	13	24	5	6
		1992/93	-	249	12	25	5	7
		1993/94	-	240	12	15	5	3

Table 1. Continued.

Subunit	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	1989/90	54	41	2	1	1	1
		1990/91	54	41	2	1	1	1
		1991/92	54	41	2	1	1	0
		1992/93	54	41	2	1	1	0
		1993/94	54	41	2	0	1	0
6D Total		1989/90	-	327	16	24	7	8
		1990/91	-	319	16	34	6	13
		1991/92	-	300	15	25	6	6
		1992/93	-	290	14	26	6	7
		1993/94	-	281	14	15	6	3
Unit 6 Total		1989/90	-	771	39	47	15	14
		1990/91	-	767	38	52	15	19
		1991/92	-	748	37	51	15	15
		1992/93	-	739	37	44	15	10
		1993/94	-	740	37	22	15	5

Table 2. Unit 6 brown bear harvest 1989-94.

Subunit	Regulatory year	Reported								Estimated illegal kill	Total estimated kill					
		Hunter kill					Non-hunting									
		M	F	(%)	Unk.	Total	M	F	Unk.		M	(%)	F	(%)	Unk.	Total
6A	1989/90															
	Fall 89	2	2	(50)	1	5	0	3	0	0	2	(29)	5	(71)	1	8
	Spring 90	6	0	(0)	0	6	0	0	0	0	6	(100)	0	(0)	0	6
	Total	8	2	(20)	1	11	0	3	0	0	8	(62)	5	(38)	1	14
	1990/91															
	Fall 90	1	1	(50)	1	3	0	1	0	0	1	(33)	2	(67)	1	4
	Spring 91	2	0	(0)	1	3	0	0	0	0	2	(100)	0	(0)	1	3
	Total	3	1	(25)	2	6	0	1	0	0	3	(60)	2	(40)	2	7
	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

Table 2. Continued.

Subunit	Regulatory year	Reported								Estimated illegal kill	Total estimated kill					
		Hunter kill					Non-hunting									
		M	F	(%)	Unk.	Total	M	F	Unk.		M	(%)	F	(%)	Unk.	Total
6B	1989/90															
	Fall 89	0	0	(0)	0	0	0	0	0	0	0	(0)	0	(0)	0	0
	Spring 90	2	2	(50)	0	4	0	0	0	1	2	(50)	2	(50)	0	5
	Total	2	2	(50)	0	4	0	0	0	1	2	(50)	2	(50)	0	5
	1990/91															
	Fall 90	2	2	(50)	0	4	0	0	0	1	2	(50)	2	(50)	0	5
	Spring 91	3	2	(40)	0	5	0	0	0	1	3	(60)	2	(40)	0	6
	Total	5	4	(44)	0	9	0	0	0	2	5	(56)	4	(44)	0	11
	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

Table 2. Continued.

Subunit	Regulatory year	Reported								Estimated illegal kill	Total estimated kill					
		Hunter kill					Non-hunting									
		M	F	(%)	Unk.	Total	M	F	Unk.		M	(%)	F	(%)	Unk.	Total
6C	1989/90															
	Fall 89	3	0	(0)	0	3	0	0	0	1	3	(100)	0	(0)	0	4
	Spring 90	1	1	(50)	0	2	0	0	0	1	1	(50)	1	(50)	0	3
	Total	4	1	(20)	0	5	0	0	0	2	4	(80)	1	(20)	0	7
	1990/91															
	Fall 90	1	0	(0)	0	1	0	0	0	1	1	(100)	0	(0)	0	2
	Spring 91	1	0	(0)	0	1	0	0	0	1	1	(100)	0	(0)	0	2
	Total	2	0	(0)	0	2	0	0	0	2	2	(100)	0	(0)	0	4
	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

Table 2. Continued.

Subunit	Regulatory year	Reported								Estimated illegal kill	Total estimated kill					
		Hunter kill					Non-hunting									
		M	F	(%)	Unk.	Total	M	F	Unk.		M	(%)	F	(%)	Unk.	Total
6D	1989/90															
	Fall 89	3	3	(50)	1	7	0	0	0	2	3	(50)	3	(50)	1	9
	Spring 90	11	6	(35)	0	17	0	0	0	1	11	(65)	6	(35)	0	18
	Total	14	9	(39)	1	24	0	0	0	3	14	(61)	9	(39)	1	27
	1990/91															
	Fall 90	8	6	(43)	2	16	0	0	1	3	8	(57)	6	(43)	3	20
	Spring 91	7	7	(50)	3	17	0	0	0	1	7	(50)	7	(50)	3	18
	Total	15	13	(46)	5	33	0	0	1	4	15	(54)	13	(46)	6	38
	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	16	(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	10	(77)	3	(23)	0	14
	Total	15	7	(32)	0	22	2	2	0	3	17	(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	12	(80)	3	(20)	0	18

Table 2. Continued.

Subunit	Regulatory year	Reported								Estimated illegal kill	Total estimated kill					
		Hunter kill					Non-hunting									
		M	F	(%)	Unk.	Total	M	F	Unk.		M	(%)	F	(%)	Unk.	Total
Unit 6 Total	1989/90															
	Fall 89	8	5	(38)	2	15	0	3	0	3	8	(50)	8	(50)	2	21
	Spring 90	20	9	(31)	0	29	0	0	0	3	20	(69)	9	(31)	0	32
	Total	28	14	(33)	2	44	0	3	0	6	28	(62)	17	(38)	2	53
	1990/91															
	Fall 90	12	9	(43)	3	24	0	1	1	5	12	(55)	10	(45)	4	31
	Spring 91	13	9	(41)	4	26	0	0	0	3	13	(59)	9	(41)	4	29
	Total	25	18	(42)	7	50	0	1	1	8	25	(57)	19	(43)	8	60
	1991/92															
	Fall 91	13	10	(43)	0	23	0	2	1	6	13	(52)	12	(48)	1	32
	Spring 92	16	9	(36)	0	25	0	0	0	2	16	(64)	9	(36)	0	27
	Total	29	19	(40)	0	48	0	2	1	8	29	(58)	21	(42)	1	59
	1992/93															
	Fall 92	12	11	(48)	0	23	2	2	0	4	14	(52)	13	(48)	0	31
	Spring 93	14	3	(18)	0	17	0	0	0	1	14	(82)	3	(18)	0	18
	Total	26	14	(35)	0	40	2	2	0	5	28	(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	15	(68)	7	(32)	0	27

Table 3. Unit 6 brown bear mean skull size and age, 1989-94.

		Males				Females			
Subunit	Year	Skull size	n	Age	n	Skull size	n	Age	n
6A	1989/90	26	8	10	7	22	2	5	2
	1990/91	24	3	7	3	19	1	4	1
	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
6B	1989/90	25	2	8	2	24	2	7	2
	1990/91	22	5	6	5	21	4	10	4
	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
6C	1989/90	23	4	7	4	21	1	5	1
	1990/91	21	2	4	2	-	0	-	0
	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
6D	1989/90	23	12	6	14	22	9	7	9
	1990/91	20	13	3	15	21	13	9	13
	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

Table 3. Continued.

		Males				Females			
Subunit	Year	Skull size	n	Age	n	Skull size	n	Age	n
Unit 6	1989/90	24	26	7	27	22	14	7	14
Total	1990/91	21	23	4	25	21	18	9	18
	1991/92	24	28	7	28	21	19	7	19
	1992/93	22	26	6	25	21	13	7	11
	1993/94	24	14	9	14	22	6	8	6

Table 4. Unit 6 brown bear successful hunter residency, 1989-94.

Subunit	Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Residency unknown	(%)	Total successful hunters
6A	1989/90	1	(9)	0	(0)	10	(91)	0	(0)	11
	1990/91	0	(0)	3	(50)	3	(50)	0	(0)	6
	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
6B	1989/90	0	(0)	0	(0)	4	(100)	0	(0)	4
	1990/91	0	(0)	0	(0)	9	(100)	0	(0)	9
	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
6C	1989/90	4	(80)	0	(0)	1	(20)	0	(0)	5
	1990/91	1	(50)	1	(50)	0	(0)	0	(0)	2
	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
6D	1989/90	0	(0)	11	(46)	13	(54)	0	(0)	24
	1990/91	6	(18)	11	(33)	16	(48)	0	(0)	33
	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

[a] Resident of Unit 6.

Table 4. Continued.

Subunit	Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Residency unknown	(%)	Total successful hunters
Unit 6	1989/90	5	(11)	11	(25)	28	(64)	0	(0)	44
Total	1990/91	7	(14)	15	(30)	28	(56)	0	(0)	50
	1991/92	8	(17)	16	(33)	24	(50)	0	(0)	48
	1992/93	6	(15)	16	(40)	18	(45)	0	(0)	40
	1993/94	3	(14)	7	(33)	10	(48)	1	(5)	21

[a] Resident of Unit 6

Table 5. Unit 6 brown bear harvest chronology percent by time period, 1989-94.

		Harvest Periods										
	Regulatory	September		October		November		April		May		Total
Subunit	year	1-15	16-30	1-15	16-31	1-15	16-30	1-15	16-30	1-15	16-31	n
6A	1989/90	36	0	9	0	0	0	9	18	9	18	11
	1990/91	17	17	17	0	0	0	0	0	17	33	6
	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
6B	1989/90	0	0	0	0	0	0	25	0	25	50	4
	1990/91	0	11	33	0	0	0	0	11	11	33	9
	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
	1989/90	40	20	0	0	0	0	0	20	20	0	5
	1990/91	0	0	0	50	0	0	0	0	50	0	2
	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
6D	1989/90	0	17	8	4	0	0	0	0	21	50	24
	1990/91	15	0	24	9	0	0	0	0	21	30	33
	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

Table 5. Continued.

Subunit	Regulatory year	Harvest Periods										Total n
		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	
Unit 6	1989/90	14	11	7	2	0	0	5	7	18	36	44
Total	1990/91	12	4	24	8	0	0	0	2	20	30	50
	1991/92	15	17	8	6	2	0	0	10	23	19	48
	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

Table 6. Unit 6 brown bear harvest percent by transport method, 1989-94.

Subunit	Regulatory year	Percent of harvest						n
		Airplane	Boat	3 or 4-Wheeler	ORV	Highway Vehicle	Unknown	
6A	1989/90	91	9	0	0	0	0	11
	1990/91	100	0	0	0	0	0	6
	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
6B	1989/90	100	0	0	0	0	0	4
	1990/91	100	0	0	0	0	0	9
	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
6C	1989/90	0	0	0	0	0	100	5
	1990/91	0	0	50	0	0	50	2
	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
6D	1989/90	29	71	0	0	0	0	24
	1990/91	33	52	0	3	0	12	33
	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

Table 6. Continued.

Subunit	Regulatory year	Percent of harvest						n
		Airplane	Boat	3 or 4-Wheeler	ORV	Highway Vehicle	Unknown	
Unit 6	1989/90	48	41	0	0	0	11	44
Total	1990/91	52	34	2	2	0	10	50
	1991/92	40	38	0	0	17	6	48
	1992/93	59	36	0	0	5	0	39
	1993/94	52	43	0	0	5	0	21

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. 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 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, together 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 to 20 June and the bag limit was 2 brown bears for coastal areas in southcentral and all of southeastern Alaska. The rest of the state did not have a closed season and there was no bag limit. At the time of statehood, the bag limit was 1 brown bear. 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. The bag limit was reduced in 1967 from 1 bear per year to 1 bear every 4 years.

Although adequate information is unavailable concerning population dynamics of brown bears on the Kenai Peninsula, inferences can be drawn from research in other regions of Alaska and Canada. 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 completed 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). The IBBST is drafting an interagency brown bear management plan using guidelines provided by Jacobs (1989). The Chugach National Forest is working on a cumulative effects model for brown bears for the Kenai (18 November 1992 memo, ADF&G Region II supervisor). 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.

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 (6 female bears) annually.

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 Tustemena 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.

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: In 1993 we estimated the brown bear population for Units 7 and 15 at 277. For management purposes a conservative population estimate of 250 bears was used to account for unoccupied habitat in and around municipalities. We see no reason to revise this estimate.

Distribution and Movements: Brown bears occur 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 15 September to 15 October and 10-25 May for subsistence, resident, and nonresident hunters.

Game Board Action and Emergency Orders. In 1989 the Board of Game shortened the fall brown bear season by 14 days, creating a fall opening date of 15 September. 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 Board shortened and moved the fall hunting season to 1-25 October in response to continued high harvest levels.

Hunter Harvest. Annual harvest levels have exceeded management objectives. Fourteen bears (7 males (50%), 6 females (43%), and 1 of unknown sex (7%)) were harvested in the fall of 1992, including 1 male and 2 female bears in Unit 7. An additional 13 bears were reported in the spring of 1993 (9 males (69%) and 4 females (31%), including 3 males and 3 females in Unit 7 (Table 1). Four bears (3 males and 1 bear of unknown sex) were reported taken in Unit 15 as nonsport mortalities.

Twelve bears (8 males (67%) and 4 females(33%) were harvested in fall 1993. One of these bears (male) was taken from Unit 7. An additional 11 bears were reported in the spring of 1994 (9 males (82%)and 2 females(18%), including 4 males in Unit 7. Five additional bears (4 males and 1 female) were killed in other ways. Two "nonsport" kills (males) occurred in Unit 7 (Table 1).

Hunter Residency and Success. Local residents took 48% and 63% of bears harvested in regulatory years 1992-93 and 1993-94, respectively. Nonlocal residents took 35% and 13%, while nonresidents took 17% and 25% in each of the 2 regulatory years, respectively (Table 2).

Harvest Chronology. The proportion of bears taken between fall and spring seasons were approximately split 50:50 (Table 3). During the fall 1993, most of the harvest shifted to October with 6 bears taken in Subunit 15B. Mild fall weather conditions and an overlap with permit moose hunts were the predominant reasons for the high Subunit 15B harvest.

Transport Methods. Successful brown bear hunters used all transportation methods with the exception of snowmachines during 1992-93 and 1993-94. Over the past five years, hunters reported the use of boats (32%) as the most common method of transport, highway vehicles (21%), and ORV's (5%) as the least used method (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.

Smith (1989) used a sex-weighted point system to encourage guided hunters and those employing outfitters to take predominantly males in Yukon Territory. Smith's system assigned a greater point value to females and then allocated a certain number of points to guides, encouraging hunters to harvest males. Management options differ on the Kenai because the guided proportion of the bear harvest is small. However, the point system has some applicability for season closures when the total number of female points has been reached or exceeded.

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

CONCLUSION AND RECOMMENDATIONS

Brown bear mortality is increasing on the Kenai, management objectives were exceeded in three of the last 5 years. The number of DLP's has increased, thereby negating the effects of season changes. 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. We should then be able to allow a mean annual harvest of 14 bears.

Taylor *et al.* (1987) noted that survival of adult female bears was the predominant factor affecting population dynamics. To maintain a population of 250 bears on the Kenai Peninsula, 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 to account for young female bears ($\leq$ 2 years of age) taken primarily in nonsport situations. These bears were assumed to have a lower reproductive value, and therefore should be assigned lower scores than those of older females. Specifically, female bears $\leq$ 2 years of age were assigned only half the value of older females. The management objectives should be revised to indicate the new 3-year mean annual harvest should not exceed 5.7 "female points." A 3-year mean allows for any 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 5.7 female points, the department should curtail the harvest. Because bears are polygamous, the number of males may not be as crucial as is 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.

Management decisions should then be made for the next calendar year by calculating the total number of female points taken during 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.

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. 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 in proximity to black bear bait stations, bear/human conflicts in important bear habitat (i.e., Russian River Skilak lake campgrounds and Caribou Hills cabin areas), private and borough dumpster problems, and bear/livestock interactions.

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 is not known for high brown bear densities. Decisions should not be made for one subunit that may potentially impact brown bears in other areas. Because the Kenai Peninsula is essentially a closed system, some areas that could support slightly higher harvests can better serve as refugia for areas that may be more highly impacted.

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Table 1. Units 7 and 15 brown bear harvest, 1989-94.

Regulatory year	Reported Hunter Kill M	F	Unk.	Total	Nonhunting kill[a] M	F	Unk.	Total estimated kill M	(%)	F	(%)	UNK.	(%)	Total
1989														
Fall 89	1	1	0	2	0	1	0	1	(33)	2	(66)	0	(0)	3
Spring 90	1	3	0	4	0	0	0	1	(25)	3	(75)	0	(0)	4
Total	2	4	0	6	0	1	0	2	(29)	5	(61)	0	(0)	7
1990														
Fall 90	4	2	0	6	1	0	0	5	(71)	2	(29)	0	(0)	7
Spring 91	2	3	0	5	1	0	1	3	(43)	3	(43)	1	(14)	7
Total	6	5	0	11	2	0	1	8	(57)	5	(35)	1	(7)	14
1991														
Fall 91	4	4	0	8	1	1	0	5	(50)	5	(50)	0	(0)	10
Spring 92	3	1	0	4	0	0	1	3	(60)	1	(20)	1	(20)	5
Total	7	5	0	12	1	1	1	8	(53)	6	(40)	1	(7)	15
1992														
Fall 92	4	6	0	10	3	0	1	7	(50)	6	(43)	1	(7)	14
Spring 93	9	4	0	13	0	0	0	9	(69)	4	(31)	0	(0)	13
Total	13	10	0	23	3	0	1	16	(59)	10	(37)	1	(4)	27
1993														
Fall 93	5	3	0	8	3	1	0	8	(67)	4	(33)	0	(0)	12
Spring 94	6	2	0	8	3	0	0	9	(82)	2	(18)	0	(0)	11
Total	11	5	0	16	6	1	0	17	(74)	6	(26)	0	(0)	23

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

Table 2. Unit 7 and 15 brown bear successful hunter residency, 1985-94.

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

[a] Local resident means residents of Units 7 or 15.
[b] Does not include nonsport harvest.

Table 3. Units 7 and 15 brown bear harvest chronology percent by time period, 1985-94.

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

[a] Does not include nonsport harvest.

Table 4. Units 7 and 15 brown bear harvest percent by transport method, 1985-93.

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

[a] Does not include nonsport harvest.

LOCATION

Game Management Unit: 8 (5,097 mi^2)

Geographical Description: Kodiak and Adjacent Islands

BACKGROUND

Brown bears inhabit Kodiak, Afognak and adjacent smaller islands in stable and relatively high populations. Most habitat is 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. 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 USFWS 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 USFWS subsequently dropped the land-use permit system. The state system allocated a minimum of 60% of the available bear permits to Alaska residents. A fixed number of permits was assigned to each of 26 hunting areas with approximately a 60:40 ratio of resident to nonresident allocations within each hunting area.

The Guide Licensing and Control Board assigned exclusive guiding areas (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.

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. The Board of Game adopted a regulation, proposed by guides, which changed the method for issuing permits to nonresident hunters from a lottery to a "first-come, first-served" registration system in 1983-84.

The Alaska Supreme Court invalidated EGAs in 1988, creating an opportunity for additional licensed guides to operate in Unit 8. As a result, fall 1989 season guides competed for permits and lined up several weeks in advance of the dates permits became available. Frequent disputes among guides and difficulty in issuing permits prompted the department to recommend nonresident permits be awarded by lottery. The Board adopted the recommended change in 1994-95 with provisions for issuing permits over the counter for undersubscribed hunts and filling cancellations from an alternate list.

Research by USFWS and ADF&G on several aspects of population status and life history of the Kodiak brown bear has been underway since 1982 (Barnes 1986; 1990; 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 improved educational programs for deer hunters.

MANAGEMENT DIRECTION

Management Objectives

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

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.

Aerial surveys and mark-recapture density estimates have been done cooperatively with USFWS in 4 study areas. Intensive aerial surveys in 1992 and 1993 in the Sturgeon River (264 km^2), Olga Lakes (262 km^2), and Aliulik Peninsula (350 km^2) compared relative abundance of bears between areas and used aerial surveys to assess population trends. The intensive aerial survey method was applied in the Karluk Lake drainage (267 km^2) in May 1994. Brown bear density and composition

was estimated in the Aliulik Peninsula study area using Lincoln-Peterson mark-resight procedures during 27-30 May, 1993. Five replicate aerial surveys were done, and a sample of 29 radiocollared bears captured in 1992 and 1993 were in the study area.

Aerial brown bear composition surveys were flown along selected streams of southern Kodiak Island by USFWS each year. ADF&G and USFWS cooperatively conducted 2 studies of the effects of sockeye salmon enhancement on brown bears. We monitored movements of 13 radiocollared bears by aerial telemetry in 1993 and 1994 in the Spiridon River study area. Sockeye salmon (*Onchorhynchus nerka*) were introduced into Spiridon Lake to establish a new commercial fishery in Spiridon Bay. A study of the effects of establishing a sockeye population in the Hidden Lake drainage of Afognak Island began in 1993. We monitored activity of brown bears at Hidden Lake Creek by observations along the stream and by recording signs of bears between June and September 1993 and 1994.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: We completed 5 replicate aerial surveys in the 350 km^2 Aliulik Peninsula study area 27-30 May, 1993 for a capture-mark-recapture brown bear density estimate. Estimated densities were 211.3 bears/1,000 km^2 for independent bears and 295.0 bears/1,000 km^2 for total bears (Barnes and Smith 1995). The estimated total population was 103.1 bears (95% CI = 87.3 - 118.8).

The brown bear density estimate for the Aliulik Peninsula compared closely to estimates developed for the Terror Lake and the southwestern Kodiak study areas in 1987. The estimated density of independent bears was 215/1,000 km^2 and 238/1,000 km^2, respectively, and the estimated density for total bears was 292/1,000 km^2 for the SW Kodiak and Terror Lake study areas combined (Barnes et al 1988). Mean sightability was highest for Aliulik Peninsula (53%), followed by southwestern Kodiak (44%), and Terror Lake (32%).

Intensive aerial surveys in 3 study areas in late May of 1992 and 1993 indicated bears were less abundant in the Olga Lakes area than in the Sturgeon River and Aliulik Peninsula study areas (Barnes and Smith 1995). The mean number of bears observed was 5.1/100 km^2 for Olga Lakes, 11.0/100 km^2 for Sturgeon River, and 16.1/100 km^2 for the Aliulik Peninsula study area. The Olga Lakes and Sturgeon River study area have similar habitat, so it is unlikely different sightability explains the large discrepancy in observed bear density.

Fewer bears were observed during intensive aerial surveys in the Sturgeon River study area in 1992 and 1993 than were found during comparable surveys in 1987 (Barnes and Smith 1995). In 1987, 12.0 independent bears/100 km^2 were observed, compared with means of 6.8 and 8.5 independent bears/100 km^2 in 1992 and 1993. Whether that change indicated a real decline will require further investigation.

We completed 4 replicate aerial surveys of a 267 km^2 study area encompassing the Karluk Lake drainage in late May, 1994. We found a mean of 29.7 bears/100 km^2, well above the previous high of 16.1 bears/100 km^2 seen in the Aliulik Peninsula study area in 1993. We believe sightability was lower in Karluk Lake than in the less heavily vegetated Aliulik study area. The 1993 survey supports the widely held opinion that the Karluk Lake area has the best brown bear habitat on Kodiak Island. The intensive aerial survey method may prove useful for indicating gross trends in bear populations. Preliminary analysis indicated the mean number of bears observed/100 km^2 exhibited less variation than did the mean number of bears observed/hr.

An extrapolated brown bear population estimate for Unit 8 (Barnes *et al* 1988) was revised to reflect results of the Aliulik Peninsula capture-mark-resight study and intensive aerial surveys since 1992. We estimated 2,040 independent bears and 2,877 total bears, an increase of 6% for independent bears and 5% for total bears compared with the previous estimate. The higher estimate reflects newly acquired information from studies since 1987, rather than a clearly defined increase in the population.

Population Composition: Aerial surveys along salmon streams in southwestern Kodiak Island by the USFWS indicate little change in composition of the brown bear population (Table 1). Single bears composed 47% and 44% of bears classified in 1992 and 1993, respectively.

Composition of brown bears in the Aliulik Peninsula study area in 1993 was estimated using Lincoln-Peterson estimates for each component and by using the minimum population, the highest count of unmarked bears in each class based on marked bears present and unmarked bears observed for a single replicate aerial survey (Barnes and Smith 1995). Single bears composed 52% and 54% of the population, maternal females 14% and 15%, and dependent offspring 31% and 33%, the first of each pair of numbers derived from the Lincoln-Peterson method, the second from the minimum population method.

Distribution and Movements: In 1993 radiocollared bears in the Spiridon Lake study area ranged in the Spiridon Peninsula, Spiridon River, and South Arm of Uganik Bay. Bears fed on salmon near Little River Lake, Spiridon River, and in upper South Arm of Uganik Bay. No movement of bears to the Spiridon Lake outlet stream was documented, although about 3,500 small male sockeye (jacks) were present in August, 1993.

We built a field camp near Foul Bay for the Hidden Lake study, and observers spent 65 hours looking for bears at 2 observation sites near Hidden Creek. No bears were observed, but tracks indicated 4 or 5 bears frequented Hidden Creek in June-August, 1993. An estimated 6,000 pink salmon (*O. gorbuscha*) and 500 coho salmon (*O. kisutch*) were found in the stream in August, but we found little sign of bears feeding on salmon.

Mortality

Harvest: Harvest data for regulatory year 1985-93 are presented in Tables 2-8. Documented human-caused annual mortality averaged 177.5 bears and ranged from 155 in 1989 to 208 in 1985 (Table 2). Mean annual mortality declined from 180.2 bears in 1985-89 to 174.3 bears in 1990-93.

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 bear by registration permit only.

Board of Game Actions and Emergency Orders. The Board of Game adopted a regulation requiring that brown bear hunting permits for nonresidents be awarded by lottery beginning in 1994-95. That change was recommended by ADF&G staff because issuing the permits on a first-come, first-served basis became nearly impossible to equitably administer. Smith (1993) discussed the increasing competition between guides operating on state and private lands after the exclusive guiding area system was ruled illegal in 1988 by the Alaska Supreme Court. Guide-outfitters initiated unsuccessful legal challenges to the hunting permit issuance procedure in 1993, and general dissatisfaction with the system mandated a change.

In reaction to an increasing trend in the sport harvest, the ADF&G staff recommended reducing the number of hunting permits in part of southwestern Kodiak Island in 1995. The Board approved an alternative proposal supported by several guide/outfitters to encourage nonresident hunters to harvest only bears meeting minimum skull size criteria. Failure to meet the minimum skull size criteria would result in future reductions in hunting permits. The assumption was that hunter success would decline and fewer females would be taken under this regulation.

Hunter Harvest. Mean annual sport harvest for 1990-1993 was 161.3 bears, slightly less than during 1985-1989 (167.6). Mean annual fall harvest was 49.3 bears during 1990-1993, compared with 58.8 bears in 1985-89. Mean annual spring harvest was 108.8 bears during 1990-93, identical to the mean annual spring kill for the previous 5 years. Mean percent females was 34% in 1990-1993, a 3% decline from 1985-1989. Mean annual females harvested during 1990-93 was 54.3, compared with 62.2 during 1985-1989.

Sport harvest has increased since the early 1970s. Mean annual sport harvest for the 10-year period 1973-1982 was 137.4 bears, compared with a mean annual take of 166.6 bears in the following 10-year period, 1983-1992. The annual harvest objective of 150 bears was met in 9 of 10 years during 1983-1992. I attribute that increase to greater use of available permits by guided nonresident hunters since 1983, when the Board of Game established a registration permit hunt for nonresidents with a provision for replacing canceled hunters. After the Exclusive Guide Area

system was eliminated in 1988, increased competition by new guides further assured that nearly all nonresident permits were used.

In analyzing the increasing harvest trend, we compared the annual harvest in 8 subdivisions of Unit 8 with the estimated number of bears in each of the 8 "subpopulations." Mean annual harvest ranged from 3.5 to 8.4% for the 8 subdivisions during 1988-1992. In 3 subdivisions of southern Kodiak Island, which included permit hunts #206-216, we recommended a 24% reduction in the number of hunting permits (12 resident and 12 nonresident permits). Our objective was to reduce the annual harvest to <6% of the extrapolated population.

Affected guide-outfitters opposed reducing the number of permits, expressing skepticism that the increasing trend in the harvest posed any risk to the population. Most guides supported an alternative proposal that would encourage nonresident hunters to harvest larger bears by setting a minimum skull size requirement. The guides reasoned that harvest would be reduced because hunter success would decline and fewer females would be killed. The Board approved the proposal and adopted criteria whereby males or females with skulls $\geq$ 15" long or $\geq$ 9" wide qualify. Only 10% of females harvested in the past had skulls that large. A hunter who kills a female will not be penalized, but 1 permit will be deducted from the nonresident allocation the following season for each female smaller than the minimum.

Permit Hunts. The number of permits issued for hunts in which permits were limited was stable in 1992 and 1993 (Table 3). Three hundred nineteen permits were available each year to residents, 107 in fall and 212 in spring. Permit use by residents averaged 61% in 1992 and 1993. Nonresidents had access to 153 permits, 53 in fall and 100 in spring. Permit use by nonresidents averaged 94%. In the northeastern Kodiak Island hunt, where permits were not limited, 203 permits were issued in 1992-1993, the highest number since 1986-1987, the last season unlimited permits were issued for Afognak Island (Table 4).

Hunter Residency and Success. Mean hunter success in the limited permit hunts was 49% in 1992-93 and 1993-94, the highest success since 1987-88 (Table 3). Nonresident hunters harvested 58% and 56% of bears taken in 1992-93 and 1993-94, respectively (Table 5).

Harvest Chronology. In the fall seasons more bears were usually killed in November than in October (Table 6). During spring seasons more bears were killed in May than in April.

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 16 bears in 1992-93 and 12 bears in 1993-94, equal to 9% and 7% of the sport hunting kill (Table 2).

The incidence of illegal or unreported DLP kills is unknown, but is estimated to equal the reported nonhunting kill. Bears which have been shot but not reported are occasionally found,

most frequently near the villages of Larsen Bay, Old Harbor, and Port Lions. Cases in which deer hunters, hikers, sportfishermen, 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, is being transferred to Native corporations. Those corporations are negotiating the sale of critical wildlife habitat back to the federal government, but they are beginning to develop subdivisions, lodges and recreational cabins close to brown bear concentrations on salmon streams and in important coastal habitat. In 1994 a parcel of private land on northeastern Afognak Island was purchased and returned to private ownership as mitigation for the Exxon Valdez oil spill. Other current developments with impacts on brown bears include commercial timber harvest on Afognak Island, proposed expansion of the Terror Lake hydroelectric project, expanding 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. In their planning efforts the Kodiak National Wildlife Refuge addressed these user groups, proposing extensive regulations to minimize human effects on important bear habitat (USFWS 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 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 operated because it was located too near a creek used for a domestic supply. Recent budget reductions in the Department of Environmental Conservation have reduced to bare minimums 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. Deer hunters should be specially targeted to reduce brown bear confrontations while hunting and camping; every year confrontations cause unnecessary bear kills.

Interest in viewing brown bears in Unit 8 is increasing with the growth of "eco-tourism" in Alaska. The USFWS established a trial bear viewing program at Dog Salmon River in 1990 modeled after the McNeil River State Game Sanctuary program. After 2 years the program was moved to a more popular site at O'Malley River, a tributary of Karluk Lake (USFWS 1992). A 3-year study by USFWS to evaluate effects on bears of the managed viewing began in June, 1991. Based on observations of bears and human disturbances in 1991 when visitor use at O'Malley River was not regulated, it was predicted a decline in bear use would accompany increased visitation by humans. In 1992 USFWS closed the O'Malley River area during the summer to all visitors except participants in the managed viewing program. The viewing program was scheduled to be operated by a private concessionaire in 1993, but USFWS did not complete administrative requirements in time, so the viewing area was open without restriction that year. The O'Malley River bear viewing concession was awarded to Munsey's Bear Camp in 1994, and the area was again closed to the public. Bear viewing and photography are increasingly being offered by local air taxis, lodges, and charter boats operating on Kodiak and the nearby Alaska Peninsula.

CONCLUSIONS AND RECOMMENDATIONS

Brown bear density estimates for 3 study areas on Kodiak Island have been obtained using capture-mark-recapture techniques since 1987. Estimated densities in the 3 areas were comparable, ranging from 211 independent bears/1,000 km^2 in the Aliulik Peninsula to 238 independent bears/1,000 km^2 in the southwestern Kodiak Island study area.

Intensive aerial surveys have potential as an economic method to assess population trends. In the Sturgeon River study area where we conducted intensive aerial surveys 3 times during 1987-1993, the mean number of independent bears/100 km^2 declined from 13.2 in 1987 to 6.8 in 1992 and climbed to 8.5 in 1993. The USFWS plans to fund an intensive aerial survey in a 250-300 km^2 area in the Kodiak National Wildlife Refuge every year. I recommend the department continue to cooperate with USFWS in doing these surveys and analyzing the results. I also recommend we conduct an intensive aerial survey in the Shearwater Peninsula area, which is mostly state-owned and where development of small parcels of private land for recreational cabins and commercial lodges is steadily increasing, with rising potential for bear/human conflicts.

A recommended reduction in the mean annual harvest in part of southern Kodiak Island was addressed by the Board of Game with a regulation restricting guided nonresident hunters to taking male or female bears with minimum skull measurements of 15" in length or 9" in width. If this regulation is not effective in reducing the harvest to <6% of the estimated bear population in the area of concern, I recommend the number of hunting permits be reduced to accomplish that objective. Miller (1990) stated that relatively long recovery periods are required for brown bear populations subjected to excessive harvest, inferring from simulation studies an annual harvest rate of 5.7% is sustainable.

Increased development of private lands for recreational cabins and commercial lodges continues to threaten the integrity of much important brown bear habitat adjacent to major rivers and coastal areas. Current negotiations between private landowners and the federal government are expected

to return large parcels to the Kodiak National Wildlife Refuge in the near future. However, some important parcels in the Karluk Lake and Ayakulik River drainages with high recreational values for sportfishing and brown bear observation will likely be retained and developed by private owners. A coordinated interagency planning effort is needed to develop strategies for maintaining a viable brown bear population in the face of increasing human encroachment.

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Table 1. Unit 8 aerial stream counts of brown bears[a], 1985-1993.

Regulatory year	No. complete surveys	Single bears No.	%	Maternal bears No.	%	Yearling+cubs No.	%	New cubs No.	%	Total
1985	10	434	54	110	14	189	24	67	8	800
1986	10	445	55	115	14	191	24	54	7	805
1987	8	205	53	58	15	92	24	31	8	386
1988	4	117	51	39	17	50	22	23	10	229
1989	9	406	46	148	17	284	32	54	6	892
1990	8	460	44	177	17	273	26	126	12	1,036
1991	9	529	52	156	15	210	21	129	13	1,024
1992	5	226	44	92	18	103	20	92	18	513
1993	6	244	47	88	17	119	23	67	13	519

[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[a], 1985-94.

Regulatory year	Reported: Hunter kill M	F	(%)	Unk.	Total	Reported: Nonhunting kill[b] M	F	Unk.	Total	Illegal kill[c] M	F	Unk.	Total	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	0	0	0	0	74	70	32	30	0	106
Total	99	52	34	0	151	2	6	1	9	1	0	0	1	102	66	52	34	1	155

Table 2. Continued

Regulatory year	Reported									Illegal kill[c]				Total kill					
	Hunter kill					Nonhunting kill[b]													
	M	F	(%)	Unk.	Total	M	F	Unk.	Total	M	F	Unk.	Total	M	(%)	F	(%)	Unk.	Total
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
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	31	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

[a] Permits required for all hunters.

[b] 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.

[c] Includes sublegal age bears, sows with cubs, out-of-season kills, and bears found shot.

Table 3. Unit 8 brown bear harvest data for permit hunt numbers 201-259, 1985-1994.

Hunt	Regulatory year	Permits Issued	Permits returned	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Males	%	Females	%	Unk.	Total[c] harvest
Fall	1985-86	84	83	2	33	67	34	63	20	37	0	54
(#201-229)	1986-87	87	85	1	45	55	21	48	23	52	0	44
	1987-88[a]	126	126	3	61	39	23	48	25	52	0	48
	1988-89[b]	139	139	6	62	38	28	57	21	43	1	50
	1989-90	127	127	5	65	35	22	52	20	48	0	42
	1990-91	124	123	2	57	43	30	59	21	41	0	51
	1991-92	119	119	8	67	33	21	58	15	42	1	37
	1992-93	128	127	4	54	46	35	63	21	37	0	56
	1993-94	118	118	3	54	47	34	64	20	36	0	54
Spring	1985-86	156	151	1	43	57	53	65	29	35	0	82
(#231-259)	1986-87[a]	164	164	2	47	53	62	73	23	27	0	85
	1987-88[b]	222	221	2	45	55	77	66	39	34	1	117
	1988-89	216	216	1	34	66	73	65	39	35	0	112
	1989-90	234	232	6	54	46	70	69	32	31	0	102
	1990-91	221	221	1	66	44	68	71	28	29	0	96
	1991-92	227	225	6	50	50	69	66	35	34	2	106
	1992-93	214	212	2	48	51	73	68	34	32	0	107
	1993-94	219	218	4	50	50	77	74	27	26	1	105
Combined Spring & Fall												
	1985-86	240	234	1	40	60	87	64	49	36	0	136
(#201-259)	1986-87	251	249	2	47	53	83	64	46	36	0	129
	1987-88[a]	348	347	3	51	49	100	61	64	39	1	165
	1988-89[b]	355	355	3	53	47	101	63	60	37	1	162
	1989-90	361	359	5	58	42	92	64	52	36	0	144

Table 3. Continued

Hunt	Regulatory year	Permits Issued	Permits returned	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Males	%	Females	%	Unk.	Total[c] harvest
	1990-91	345	344	1	57	43	98	67	49	33	0	147
	1991-92	346	344	6	57	43	90	64	50	36	3	143
	1992-93	342	339	3	50	49	108	66	55	34	0	163
	1993-94	337	336	4	51	49	111	70	47	30	1	159

[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, 1985-1994.

Hunt	Regulatory year	Permits Issued	Permits returned	Hunters afield	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Males	%	Females	%	Unk.	Total[c] harvest
Fall	1985-86	535	495	-	29	92	8	17	61	11	39	0	28
(#201-229)	1986-87	425	387	-	39	92	8	3	16	16	84	0	19
	1987-88	106	102	-	53	98	2	2	100	0	-	0	2
	1988-89	85	78	-	46	92	8	2	50	2	50	0	4
	1989-90	88	80	-	43	94	6	3	100	0	-	0	3
	1990-91	54	51	-	30	100	0	0	-	0	-	0	0
	1991-92	110	108	-	40	94	6	4[c]	80	1	20	0	5[c]
	1992-93	103	102	71	30	90	10	4	67	2	33	1	7
	1993-94	86	86	48	44	98	2	1	100	0	0	0	1
Spring	1985-86	154	141	-	25	83	17	16	84	3	16	0	19
(#231-259)	1986-87	140	136	-	23	84	16	9	56	7	44	0	16
	1987-88	51	51	-	57	86	14	2	67	1	33	0	3
	1988-89	50	41	-	22	100	0	0	-	0	-	0	0
	1989-90	55	51	-	41	87	13	4	100	0	-	0	4
	1990-91	63	60	-	37	95	5	1	50	1	50	0	2
	1991-92	73	71	-	15	87	13	3	38	5	62	0	8
	1992-93	98	92	66	28	91	9	1	20	4	80	1	6
	1993-94	70	68	45	34	91	9	1	25	3	75	0	4

Table 4. Continued.

Hunt	Regulatory year	Permits Issued	Permits returned	Hunters afield	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Males	%	Females	%	Unk.	Total[c] harvest
Combined Spring & Fall													
	1985-86	689	636	-	28	90	10	33	67	14	33	0	47
(#201-259)	1986-87	565	523	-	35	90	10	12	34	23	66	0	35
	1987-88[a]	157	153	-	54	94	6	4	80	1	20	0	5
	1988-89[b]	135	119	-	38	96	4	2	50	2	50	0	4
	1989-90	143	131	-	42	92	8	7	100	0	-	0	7
	1990-91	117	111	-	34	97	3	1	50	1	50	0	2
	1991-92	183	179	-	30	91	9	7[c]	54	6	46	0	13[c]
	1992-93	203	194	137	29	91	9	5	45	6	55	2	13
	1993-94	156	154	93	30	95	5	2	40	3	60	0	5

[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, 1985-94.

Regulatory year	Local[b] resident	(%)	Nonlocal resident	(%)	Nonresident[c]	(%)	Total successful hunters
1985/86	95	51	----		90	49	185
1986/87	66	40	----		100	60	166
1987/88	78	46	----		92	54	170
1988/89	71	43	----		94	57	165
1989/90	11	7	49	33	90	60	150
1990/91	7	5	47	32	95	63	149
1991/92	14	9	53	34	88	57	155
1992/93	16	9	58	33	103	58	177
1993/94	6	4	66	40	91	56	163

[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 nonresidents 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.

Table 6. Unit 8 brown bear harvest chronology by season and month, 1985-1994.

Regulatory year	Fall					Spring					Regulatory year Total[a]
	October		November		Total	April		May		Total	
	No.	%	No.	%	No.	No.	%	No.	%	No.	
1985-86	31	37	52	63	83	49	47	55	53	104	187
1986-87	24	38	39	62	63	39	39	61	61	100	163
1987-88	28	57	21	43	49	41	34	80	66	121	170
1988-89	17	31	37	69	54	40	36	72	64	112	166
1989-90	21	47	24	53	45	36	34	70	66	106	151
1990-91	22	43	29	57	51	46	47	52	53	98	149
1991-92	20	49	21	51	41	50	44	64	56	114	155
1992-93	31	49	32	63	63	52	46	62	54	114	177
1993-94	27	50	27	50	54	52	48	57	52	109	163

[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, 1985-94.

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1985-86	82	0	13	0	0	1	3	1	187
1986-87	81	0	18	0	0	0	1	0	163
1987-88	85	0	12	0	0	1	0	2	170
1988-89	74	0	24	0	0	0	0	2	166
1989-90	73	1	21	1	0	0	1	4	151
1990-91	72	0	25	0	0	1	1	1	149
1991-92	51	0	41	0	0	1	7	0	156
1992-93	69	1	22	3	0	0	5	0	177
1993-94	72	0	40	2	0	0	1	0	163

[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, 1980-81 through 1993-94.

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

LOCATION

Game Management Unit: 9 (33,638 mi^2)

Geographic Description: Alaska Peninsula

BACKGROUND

The Alaska Peninsula is a primary producer of large brown bears, and the Board of Game has placed a high priority on maintaining the quality of this population. Because of relatively easy aircraft access and the high quality of bear trophies in Unit 9, an active guiding industry developed during the 1960s. As hunting pressures 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 (1995) analyzed population data collected at McNeil River.

An intensive study was conducted during the early 1970s near Black Lake in the central portion of Subunit 9E. Three hundred and forty-four bears were captured and marked during 1970-75 to acquire information on reproductive performance, movements, and harvest rates. More recently, efforts have been directed at further analyzing the data from this study to better understand the population dynamics of an exploited bear population. In 1988 an interagency study was initiated at Black Lake to assess the current status of the bear population (Sellers, in press), and to make comparisons with conditions in the early 1970s. The 1989 *Exxon Valdez* oil spill (EVOS) lead 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. in press).

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 prevent harvests from exceeding 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 was unconstitutional. This allowed the number of registered guides operating in Unit 9 to increase; however, federal land management agencies did not issue commercial-use licenses to new guides on federal lands. This limited new guides to hunting on either state or private lands. The USFWS reallocated guide areas in January 1993, and the Big Game Commercial Services Board's new guide area system was in place by October 1993. 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 at least 8 years of age 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 ratios, 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. Although this approach has not been abandoned, harvest data have inherent problems (Miller and Miller 1990), and 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 USFWS, and in Katmai National Park by NPS. The ADF&G entered into a cooperative agreement with the USFWS and NPS to conduct a comprehensive study near Black Lake; 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 until 1985. Although the population remains high, growth has stopped. Aerial surveys at Black Lake from 1985-92 indicated a stable population (Sellers in press).

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 census at Black Lake showed a density of 1 bear/2.08 mi^2 for a 469 mi^2 study area. Within the study area density varied among count units from 1 bear/per square mile to 1 bear per 7 square miles, depending on habitat type (Miller and Sellers 1992). Results from this census were extrapolated to all of Unit 9 (Sellers and Miller 1991). Estimated population size by subunit was 296, 879, 429, 3,176, and 900 for 9A, 9B, 9C, 9E, and 9D, respectively. 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 5,679 bears, with a density of 1 bear/4.13 mi^2 (93 bears/1,000 km^2) (Sellers and Miller 1991). I estimated that national parks within Unit 9 and McNeil River State Game Sanctuary contain an additional 2,000-2,500 brown bears.

Population Composition: Evidence from the ongoing Black Lake study and analysis of harvest data indicate a change in population composition since the early 1970s that is correlated with differences in harvest rates. Black Lake capture samples of the early 1970s showed an adult (i.e., at least 5 years old) sex ratio of adult males to adult females (21:100). The 1988-89 capture sample showed a significantly higher ratio of 39 males:100 females ($t = 1.62$, $df = 194$, $P = 0.052$). Mean age of adult males increased from 7.19 years in the early 1970s to 9.92 years in 1988 (Mann-Whitney, $T = 87.5$, $P = 0.080$) (Sellers in prep.). Mean age of adult females also increased from a mean of 9.6 years during the early 1970s to 12.2 years for 1988 (Mann-Whitney, $T = 1,345$, $P = 0.003$).

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 that 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 1,365 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 2,078 bears classified from 1967 to 1976 when the population was affected by excessive harvests. Restrictive regulations, beginning in 1974, lead to reduced harvests, and the population began recovering during the late 1970s and early 1980s. During 1984-92 a mean of 36% (range = 27-49%) of 5,896 bears classified during stream surveys were single, significantly higher than during 1967-76 ($t = 5.42$, $P = < 0.001$), yet lower than during the period of 1958-61 ($t = 2.40$, $P = 0.052$).

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

Mortality

Harvest:

Season and Bag Limit. The hunting season in Subunit 9C, Naknek River drainage, was held from 1 September to 31 October and from 1 May to 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 October to 21 October in odd-numbered years and 10 May to 25 May in even-numbered years. The season for the remainder of Unit 9, including the registration permit hunt in the Cold Bay road system, was 7 October to 21 October in odd-numbered years and 10 May to 25 May in even-numbered years. The bag limit was 1 bear every 4 regulatory years.

Game Board Action and Emergency Orders. Because changes made in 1990 to the Cold Bay registration permit hunt were not codified in 5AAC, the fall 1992 and spring 1993 seasons were closed by emergency order. The fall 1993 and spring 1994 hunts were closed by emergency order after hunters took the quota of 2 bears.

In 1991 legislation was passed to enlarge 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 meetings in 1991 and 1993. Based on past harvests and estimated bear densities, the department recommended harvests in that portion of Subunit 9A from Contact Point south to the boundary of McNeil River State Game Sanctuary, averaging no more than 3 brown bears per calendar year. The Board decided to continue bear hunting in this area under a drawing permit scheduled to begin in 1995.

Hunter Harvest. During the 1992-93 regulatory year, only the Naknek registration hunt was open; hunters took 15 bears. The reported harvest for the 1993-94 regulatory year was 479 bears, including 334 males (70%), 143 females (30%), and 2 bears of unspecified sex. Additionally, 6 bears were killed in nonhunting circumstances (Table 1). I estimated the actual nonsport mortality to be 50 bears. The 1993-94 harvest was the lowest since 1985-86. Subunit 9E experienced the largest drop in harvests, while 9B and 9C had slightly higher harvests than in recent years (Tables 2-7). Harvests from both the fall and spring hunts had declined, but apparently for different reasons. During fall 1993 fewer hunters were afield. This was probably due to a combination of the following factors: fewer guided hunters were authorized on federal lands under the new guide area system, poor economic conditions, both domestically and globally; and the loss (through retirement) of one popular air-taxi operation. Hunter numbers during the May 1994 season were

near normal, but unfavorable spring weather, particularly in subunits 9D and 9E, reduced hunter success.

From 1987 to 1991, males accounted for 65% of the harvest, and for 70% in 1993-94. The number of trophy-sized males (i.e., at least 8 years old) in the harvest has increased from a mean of 51 (range = 41-58) during the period of population recovery from 1975-76 through 1981-82, to 73 (range = 61-80) for 1983-84 through 1987-88, to 116 for 1989-88 through 1993-94. 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% for 1975-76 through 1981-82, 16.9% for 1983-84 through 1987-88, and 22.3% for 1989-90 through 1993-94. It should be noted these changes in harvest patterns occurred over a period when hunting regulations were relatively stable.

Permit Hunts. The registration permit hunt in the Naknek drainage was designed to minimize bear/human conflicts in the most heavily settled portion of Unit 9. Participation in fall hunts increased because some moose and caribou hunters obtained a permit "just in case" they encountered a bear. During the 1992 regulatory year, 6 bears (5 males and 1 female) were killed during the fall, and 7 males and 1 female were killed during the spring hunt (Table 7). During the 1993 regulatory year, 4 males and 2 females were killed during the fall, and 4 males and 1 female were taken in the spring (Table 7). Since the 1987 regulatory year, about half of the bears taken in this permit hunt were either confirmed or suspected of having been in conflict with humans. Participation in the fall hunt has declined in the past 2 years (Table 7), and the conflicts described in the previous management report have subsided.

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 authorized this hunt when it was determined problem bears were present. The hunt was not conducted until fall 1989. During this period, the bear population increased, and the USFWS 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 1993, the quota was exceeded when 3 bears were taken in 2 days. Because of the apparent abundance of bears, the spring 1994 quota was not reduced, and 2 bears were killed. For both seasons combined, 16 hunters received permits (Table 8). Although some administrative problems remained unresolved, this system was preferable to the uncertainties of previous years.

Hunter Residency. Compared with the previous 2 years, nonresidents took a smaller percentage (70%) of the 1993-94 harvest (Table 9). The number of nonresident hunters increased from 296 in 1985 to 409 in 1991-92. This resulted from a combination of some established guides booking more clients, as well as from an influx of new guides, especially in 1989-90 after the state Supreme Court ruled against exclusive guide areas. By 1993 both federal and state guide regulations were implemented. Fewer guides, and in some cases fewer clients, were approved under commercial use permits on federal lands in Unit 9.

Harvest Chronology. Before 1985 the fall season began 7 October. When the opening date was advanced to 1 October, the pattern of harvest also shifted (Table 10), and during 1985-89 47% of the fall harvest occurred during the first 6 days of October. The composition of the fall harvest was examined to determine whether adult females were harvested in a higher proportion during any part of the 3-week season, but no pattern was evident. The percentages of adult females in the harvest for 1985-89 were 25.6%, 27.5% and 26.5% for 1-6 October, 7-14 October, and 15-21 October, respectively. The opening date for the general season in 9C, 9D, and 9E was moved back to 7 October in 1991.

The chronology of the spring hunt can be affected by weather. For example, the late spring of 1986 caused very low hunter success during the first week of the season. May 1994 was also unseasonably cold, but the proportion of the harvest taken the first week of the season was normal (Table 10). Without data on effort by unsuccessful hunters, it is not possible to accurately compare annual variations in success rates.

Transportation Methods. During unitwide brown bear hunts, over 80% of successful hunters used aircraft, with boats being the next most common method of transportation (Table 11).

Other Mortality: Nonhunting and illegal kills, including DLP kills, are rarely reported. During 1992-93 and 1993-94, only 12 nonhunting kills were legally reported and surrendered to the state. No reduction in bear/human conflicts around villages has occurred, and the 1992 fatal mauling of a young boy in King Cove may have led to even more bears being killed illegally. Confirmed and rumored bear kills (villages, lodges, commercial fishermen) in Unit 9 indicate an unreported DLP kill of at least 50-100 bears per year.

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. For the first 7 years of this study, annual survival rates for cubs, yearlings, and females >2 years of age were 0.6, 0.8, and 0.9, respectively (Sellers in press).

Nonregulatory Management Problems/Needs

Considering the magnitude of nuisance bear problems, the department should place a high priority on the production of a quality educational video on how to avoid conflicts with bears and how to behave in a bear encounter.

CONCLUSIONS AND RECOMMENDATIONS

Brown bear populations do not lend themselves to convenient methods of monitoring trends in density or composition. Harvest statistics are useful, but a manager cannot expect to confidently appraise the status of the population solely from sex and age composition of the harvest. Stream surveys on the Alaska Peninsula should be continued. The Black Lake surveys indicated a stable and high population. Harvests have increased significantly during the 1980s, and the population seems to have stopped growing. In 1990 we presented the Board with our best population

estimates extrapolated from the Black Lake study. For the area of Unit 9 open to hunting, this estimate was 5,679 bears. During 1987-94, the calendar year harvests have been 263, 254, 291, 269, 275, 274, 254 and 246. A sport harvest of 250 bears and an estimated illegal/DLP kill of 50 bears per year result in an annual harvest rate of 5.3%.

The regulation change implemented in 1991 stabilized the harvest at the prescribed level, and new guide regulations in 1993 may have reduced harvests. I do not recommend establishing new harvest guidelines based on extrapolated population estimates for each subunit.

Although local management issues continue to move toward micromanagement (e.g. McNeil Refuge, Katmai Preserve, Naknek registration hunt, the Joshua Green Controlled Use Area), major regulatory changes are not recommended at this time. Uncertainties about population estimates, allowable harvest rates, unreported DLP kills, and predicted future hunter demand all warrant conservative management.

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Table 1. Unit 9 Brown Bear Harvest including permit hunts, 1989-1994.

Regulatory year	Reported: Hunter kill M	F	Unk.	Total	Nonhunting kill[a] M	F	Unk.	Total reported kill M (%)	F (%)	Unk. (%)	Total
1989											
Fall 89	164	112	11	287							
Spring 90	199	58	5	262							
Total	363	170	16	549	5	1	1	368 (66)	171 (31)	17 (3)	556
1990											
Fall 90	4	2	0	6							
Spring 91	2	0	1	3							
Total	6	2	1	9	1	3	1	7 (47)	5 (33)	3 (20)	15
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

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

Table 2. Subunit 9A brown bear harvest, 1989-1994.

Regulatory year	Reported: Hunter kill M	F	Unk.	Total	Nonhunting kill[a] M	F	Unk.	Total reported kill M (%)	F (%)	Unk. (%)	Total
1989											
Fall 89	5	6	1	12							
Spring 90	25	7	1	33							
Total	30	13	2	45	0	0	0	30 (70)	13 (30)	2	45
1990											
Fall 90	0	0	0	0							
Spring 91	0	0	0	0							
Total	0	0	0	0	0	0	0	0	0	0	0
1991											
Fall 91	9	9	1	19							
Spring 92	18	5	1	24							
Total	27	14	2	43	0	0	0	27 (66)	14 (34)	2	43
1992											
Fall 92	0	0	0	0							
Spring 93	0	0	0	0							
Total	0	0	0	0	0	0	0	0	0	0	0
1993											
Fall 93	6	2	0	8							
Spring 94	21	7	0	28							
Total	27	9	0	36	0	0	0	27	9	0	36

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

Table 3. Subunit 9B brown bear harvest,1989-1994.

Regulatory year	Reported: Hunter kill M	F	Unk.	Total	Nonhunting kill[a] M	F	Unk.	Total reported kill M (%)	F (%)	Unk. (%)	Total
1989											
Fall 89	10	10	0	20							
Spring 90	8	1	2	11							
Total	18	11	2	31	0	0	0	18 (58)	11 (35)	2	31
1990											
Fall 90	0	0	0	0							
Spring 91	0	0	0	0							
Total	0	0	0	0	0	1	0	0	1 (100)	0	1
1991											
Fall 91	17	10	0	27							
Spring 92	4	3	0	7							
Total	21	13	0	34	0	0	0	21 (62)	13 (38)	0	34
1992											
Fall 92	0	0	0	0							
Spring 93	0	0	0	0							
Total	0	0	0	0	0	0	0	0	0	0	0
1993											
Fall 93	20	8	1	29							
Spring 94	6	0	0	6							
Total	26	8	1	35	1	0	0	27 (75)	8 (22)	1(3)	36

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

Table 4. Subunit 9C brown bear harvest[a], 1989-1994.

Regulatory year	Reported: Hunter kill M	F	Unk.	Total	Non-hunting kill[b] M	F	Unk.	Total reported kill M (%)	F (%)	Unk. (%)	Total
1989											
Fall 89	9	2	0	11							
Spring 90	7	1	0	8							
Total	16	3	0	19	3	1	0	19 (83)	4 (17)	0	23
1990											
Fall 90	4	2	0	6							
Spring 91	2	0	1	3							
Total		6	2	1	9	0	0	0	6 (75)	2 (25)	19
1991											
Fall 91	13	3	0	16							
Spring 92	4	4	0	8							
Total	17	7	0	24	3	4	0	20 (65)	11 (35)	0	31
1992											
Fall 92	6	1	0	7							
Spring 93	6	1	0	7							
Total	12	2	0	14	1	0	0	13 (87)	2 (13)	0	15
1993											
Fall 93	13	6	0	19							
Spring 94	10	2	0	12							
Total	23	8	0	31	2	1	0	25 (74)	9 (26)	0	34

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

Table 5. Subunit 9D brown bear harvest[a], 1989-1994.

Regulatory year	Reported: Hunter kill M	F	Unk.	Total	Non-hunting kill[b] M	F	Unk.	Total reported kill M (%)	F (%)	Unk. (%)	Total
1989											
Fall 89	37	24	0	61							
Spring 90	49	16	0	65							
Total	86	40	0	126	0	0	0	86 (68)	40 (32)	0	126
1990											
Fall 90	0	0	0	0							
Spring 91	0	0	0	0							
Total	0	0	0	0	0	0	1	0	0	1	1
1991											
Fall 91	20	23	1	44							
Spring 92	51	18	0	69							
Total	71	41	1	113	0	0	0	71 (63)	41 (37)	1	113
1992											
Fall 92	0	0	0	0							
Spring 93	0	0	0	0							
Total	0	0	0	0	1	0	0	1	0	0	0
1993											
Fall 93	27	23	0	50							
Spring 94	49	13	1	63							
Total	76	36	1	113	0	1	0	76 (67)	37 (33)	1 (1)	114

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

Table 6. Unit 9E brown bear harvest, 1989-1994.

Regulatory year	Reported: Hunter kill M	F	Unk.	Total	Nonhunting kill[a] M	F	Unk.	Total reported kill M (%)	F (%)	Unk. (%)	Total
1989											
Fall 89	103	70	10	183							
Spring 90	110	33	2	145							
Total	213	103	12	328	1	0	2	214 (65)	103 (31)	14(4)	331
1990											
Fall 90	0	0	0	0							
Spring 91	0	0	0	0							
Total	0	0	0	0	1	2	1	1	2	1	4
1991											
Fall 91	103	63	0	166							
Spring 92	120	38	2	160							
Total	223	101	2	326	2	6	0	225 (69)	107 (31)	2	334
1992											
Fall 92	0	0	0	0							
Spring 93	0	0	0	0							
Total	0	0	0	0	0	2	0	0	2	0	2
1993											
Fall 93	94	47	0	141							
Spring 94	88	35	0	123							
Total	182	82	0	264	1	0	0	183 (69)	82 (31)	0	265

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

Table 7. Unit 9C, Naknek Drainage, brown bear harvest data by permit hunt. 1989-94.

Hunt No. /Area	Year	Permits issued	Number did not hunt	Number unsuccesssful hunters	Number successful hunters	Number did not report	Males	Females	Total
261F	1989	52	4	15	8	25	6	2	8
	1990	51	4	13	6	31	4	2	6
	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
261S	1990	14	2	5	0	7	0	0	0
	1991	12	0	9	3	0	2	0	3[a]
	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

[a] Includes 1 of unknown sex.

Table 8. Unit 9D, Cold Bay, brown bear harvest data by permit hunt. 1989-94.

Hunt No. /Area	Year	Permits issued	Number did not hunt	Number unsuccesssful hunters	Number successful hunters	Number did not report	Males	Females	Total
362F	1989	14	0	6	2	6	2	0	2[a]
	1990		No hunt						
	1991	8	0	6	2	0	2	0	2[a]
	1992		No hunt						
	1993	10	0	7	3	0	2	3	3
372S	1990	13	0	5	2	6	1	1	2[a]
	1991		No hunt						
	1992	4	0	2	2	0	1	1	2[a]
	1993		No hunt						
	1994	6	0	4	2	0	0	2	2

[a]Harvest quota of 2 bears; hunt closed by emergency order.

Table 9. Unit 9 brown bear successful hunter residency[a] 1989-93.

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

[a]Includes permit hunt harvest.

Table 10. Unit 9 harvest chronology percent by time period, 1981-93.

Regulatory year	October harvest			May harvest	
	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	62	26	58	42

[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 11. Unit 9 brown bear harvest[a] by transport methods, 1989-1993.

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3 or 4-wheeler	Snowmachine	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

[a]Includes permit hunt harvest.

LOCATION

Game Management Unit: 10 (1,536mi^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 (USFWS) 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. The primary management objective is to 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 DIRECTION

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 USFWS 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 is maintained by natural regulatory mechanisms at a relatively stable level.

Population Size: Brown bear population size and density were not specifically evaluated on Unimak Island. Results of past surveys and extrapolation of density estimates made elsewhere in Alaska indicated over 200 bears on the island.

Mortality

Harvest:

Season and Bag Limit. The open seasons for residents and nonresidents were 1-21 October and 10-25 May. The bag limit was 1 brown bear every 4 regulatory years by drawing permit only; 15 permits were issued annually.

Game Board Action and Emergency Orders. In March 1993 the Board adopted a proposal to extend the fall hunt through 31 December. This proposal was made by a hunter who wanted to hunt late when pelt condition might be better than during October.

Hunter Harvest. Since 1985 annual harvests from Unimak Island have averaged 6 bears (range = 4-8). Males have composed 80% of the harvest since 1987 (Table 1).

Hunter Residency and Success. In the past 5 years, 10% of successful hunters were nonresidents, versus 72% for Unit 9. Two nonresidents received permits for the October 1993 season but were forced to hunt in Unit 9 because neither their guide nor any others had registered to guide in Unit 10. One hunter appealed to the department and was issued another permit for the May 1994 season. By then, the Big Game Commercial Services Board had adopted an emergency regulation to allow guides to temporarily register for vacant areas.

Approximately 36% of permittees did not hunt on Unimak Island. Of those who actually hunted, 60% were successful.

CONCLUSIONS AND RECOMMENDATIONS

The brown bear population on Unimak Island is 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 INWR and the entire island 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, 1989-93.

Hunt No. /Area	Regulatory year	Permits issused	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Harvest M	F	Total
275 Fall	1989-90	8	50	0	100	3	1	4
Unit 10	1990-91	8	37	0	100	5	0	5
	1991-92	8	13	43	57	1	3	4
	1992-93	8	50	75	25	1	0	1
	1993-94	8	37	20	80	4	1	5
276 Spring	1989-90[a]	7	33	75	25	1	0	1
Unit 10	1990-91[a]	7	0	50	50	3	0	3
	1991-92	7	86	100	0	0	0	0
	1992-93	7	43	0	100	4	0	4
	1993-94[a]	8	12	33	67	3	1	4
Totals for	1989-90	15	40	38	62	4	1	5
all permit	1990-91	15	21	27	73	8	0	8
hunts	1991-92	15	47	50	50	1	3	4
	1992-93	15	47	38	62	5	0	5
	1993-94	16	25	27	73	6	2	8

[a] One permittee did not report.

LOCATION

Game Management Unit 11 (13,257 mi^2)

Geographical Description Wrangell Mountains

BACKGROUND

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

Brown bear harvests averaged 16 (range = 8-27) bears per year throughout the 1960s and 1970s but declined substantially after 1978, when much of Unit 11 was included in Wrangell-Saint Elias National Park and Preserve. Since 1979 hunting pressure has declined and harvests have averaged only 7 bears (range = 3-12) per year.

MANAGEMENT DIRECTION

Management Objectives

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

METHODS

We monitored brown bear harvest by sealing skulls and hides of harvested bears. Skulls of sealed bears were measured, sex of bears determined, and a premolar tooth extracted for aging. Information on date and location of harvest and number of days afield was obtained 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 suggested a relatively abundant and well-distributed population of brown bears. A population trend was not evident.

Distribution and Movements: Based on incidental observations and harvest locations, brown bears inhabit all habitats within Unit 11 except high elevation glaciers. There has not been a bear movement study conducted in Unit 11, but we suspect the movement patterns are similar to those in Unit 13. After den emergence, most bears, except females with cubs-of-the-year (COYS), move into riparian areas to feed on sprouting plants and overwintered berries. They also scavenge carcasses of ungulates that died during winter. Females with COYS tend to stay at higher elevations to avoid contact with other bears. Throughout the summer, brown bears in Unit 11 feed in many habitats. In late summer, bears generally move into subalpine habitats to feed on ripening blueberries. Bears feed on salmon in many streams throughout Unit 11 but especially in the lower Chitina River Valley during late summer and fall. Most brown bears in Unit 11 probably den at elevations >3,500 feet with a preference for southern aspects.

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.

Game Board Actions and Emergency Orders. In view of reduced hunter effort, season dates were liberalized in 1981 and 1982 to provide more hunting opportunities. During spring 1989 the Board extended the spring season by 6 days. This action was taken to align the closing date with Unit 13. This was not expected to, and has not resulted in, substantially increase the harvest. 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 BOG action on Unit 11 brown bears since 1989.

Hunter Harvest. Six brown bears were reported killed during 1992-93 while only 4 bears were reported during 1993-94 (Table 1). Percent males in the harvest met or exceeded current management guidelines of 50% or more males in the take in both years. The mean age for males was 6.4 years in 1992-93 and 16.5 years in 1993-94. The mean age for males over the past 10 years was 8.7 years.

Hunter Residency and Success. Nonresident hunters took 2 brown bear during each of the last 2 seasons (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 = 0-6) since 1978. Local residents harvested 2 bears during 1992-93 but none in 1993-94. Successful bear hunters averaged 3.7 days hunting during 1992-93 and 3.3 days in 1993-94. The 20-year hunter effort data shows a mean of 3.8 days spent to take a bear in Unit 11.

Harvest Chronology. Sixty-seven percent of the 1992-93 and 50% of the 1993-94 brown bear harvest occurred during the fall (Table 3). Since initiating sealing records in 1961, over 80% of

the Unit 11 brown bear harvest occurred 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 spring and was attributed to increased guiding activity. Spring harvests were higher in the 1970s when more guides were active in Unit 11.

Transport Methods. During the past few years, aircraft and highway vehicles were the most important method of transportation, followed by ORV's and boats (Table 4). In previous years successful hunters reported using aircraft more 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: There were no bears reported taken in Defense of Life or Property (DLP) or by another nonhunting means during the last 3 years. Historically, nonhunting kills were all taken in defense of life or property. Although much of the unit is remote with few cabins, most bear problems that result in the killing of a problem bear are 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 increase reporting compliance but might also increase DLP kills as the requirement to salvage the hide may be a deterrent to killing bears.

Habitat

Assessment: Because of the remoteness of this unit, few cabins or homesites are in Unit 11. Future settlement will be limited because much of the land is now included in Wrangell-St. Elias National Park. Private inholdings or Park Service facilities are the only source of development, especially along the McCarthy Road and at McCarthy. The number of people living and visiting McCarthy has increased in recent years; as a result, bear problems may become more frequent and result in more DLP bears. Overall, Unit 11 is considered good brown bear habitat because of the variety of vegetation types, large tracts of undeveloped land, and many 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 to 1989 subsistence hunting for brown bears by local residents was allowed in "park" designated areas. However, aircraft use was not allowed to access park areas, thus effectively closing most of the park to bear hunting. The NPS closed subsistence brown bear hunting in 1989 after the Alaska Board of Game determined 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," less than one-half of Unit 11.

The percent harvest of males has remained consistent since 1961, averaging 61%. This met the management objective of maintaining a minimum of 50% males in the harvest. Recently mean age and skull sizes fluctuate widely each year because of small sample size. Generally, bears taken in Unit 11 were older and larger than those taken in adjacent Unit 13, where harvest rates were higher.

Bear harvests were very low and 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[a], 1989-94.

Regulatory year	Hunter kill					Nonhunting kill[a]			Estimated kill[b]		Total estimated kill					
	M	F	(%)	Unk.	Total	M	F	Unk.	Unreported	Illegal	M	(%)	F	(%)	Unk.	Total
1989-90																
Fall 89	2	2	(50)	1	5	--	--	--	--	--	2	(50)	2	(50)	1	5
Spring 90	5	2	(27)	--	7	--	--	--	--	--	5	(71)	2	(29)	--	7
Total	7	4	(33)	1	12	0	0	0	1	1	7	(64)	4	(36)	3	14
1990-91																
Fall 90	5	3	(38)	--	8	--	--	--	--	--	5	(63)	3	(38)	--	8
Spring 91	0	1	(100)	--	1	--	--	--	--	--	0	(0)	1	(100)	--	2
Total	5	4	(44)	--	9	0	1	0	1	1	5	(50)	5	(50)	2	12
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

[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, 1989-94.

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

[a] Local means residents of Units 11 or 13.

Table 3. Unit 11 brown bear harvest chronology percent by time period, 1989-94.

Regulatory year	Harvest percent				*n*
	September	October	April	May	
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

Table 4 . Unit 11 brown bear harvest percent by transport method, 1989-94.

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3-or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*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

LOCATION

Game Management Unit: 12 (10,000 mi^2)

Geographical 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 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 Unit 12 that were mined extensively or had human settlements, the bear population since the early 1900s has been periodically regulated at low levels.

Since 1900 grizzly bears have been actively sought by hunters in southeastern Unit 12. Bear hunting regulations became more restrictive at the time of statehood until the early 1980s as guiding activity increased in the unit. During the 1970s the unit's moose population declined substantially, and grizzly bears were an important predator on moose calves. If a grizzly bear population was reduced by at least 60%, moose calf survival increased significantly (Ballard and Miller 1990). In an attempt 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 call for reduction of grizzly bear harvests until moose numbers approach stated objectives or there is indication the harvest levels are too high to ensure the viability of the bear population.

MANAGEMENT DIRECTION

Management Goal

The management goal is to provide maximum opportunity to participate in hunting grizzly bears. In recent years Unit 12 bears have also been managed to allow recovery of moose populations. Regardless of management goals to benefit moose, bears in Unit 12 will be managed to ensure long-term viability of the grizzly population.

Management Objectives

Manage to effect temporary reductions in the grizzly bear population or the extent of bear predation where bear predation is limiting moose population growth (e.g., below food-limiting densities with fall calf:cow ratios <25:100).

After moose populations increase to desired levels, reduce bear harvests to reverse bear population declines.

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, and extract a premolar tooth. Other hunt-related information is also recorded. Premolar teeth are sent to Matson's Laboratory, Milltown, MT to be aged.

RESULTS AND DISCUSSION

Population Status and Trend

I estimate the current Unit 12 grizzly bear population ranges from 290 to 426 bears (15.0-22.0 bears of all ages/1000 km^2). The estimate was based on extrapolations from point estimate surveys in similar habitats. To monitor grizzly bear population trend, I used harvest statistics (total harvest, sex ratio, mean skull size, and mean age of harvested bears), informal public surveys, and questionnaires. If the population estimate is accurate, harvest rate exceeded 5.7% in the mid-1980s and remained near or above sustainable levels until 1988. Average male skull sizes and age have remained consistent since 1977, but average female skull size and age have increased since 1986. The harvest was composed of 54.4% males from 1977 to 1980, 56.8% between 1981 and 1987, and 63.8% since 1987.

Much of Unit 12 is difficult to access; consequently, harvest is concentrated in a few areas. The 4 areas where most of the harvest has occurred are the Tok River drainages, near the Nabesna Road, upper Tetlin River drainages, and the Chisana River area. The estimated kill density for these areas ranged from 4.1 bears/1000 mi^2 (Chisana and Nabesna/upper Tetlin) to 3.6 bears/1000 mi^2 (Tok River drainages) This level of harvest probably has caused a local population decline. 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 during a period the bear population was estimated to have declined by 38% (Gardner, unpubl data). In the remainder of Unit 12, the kill density has averaged 0.37 bears/1000 mi^2 and probably has not affected population trend.

Mortality

Harvest:

Season and Bag Limit. The following season and bag limit was in effect for the 1994-1995 regulatory year.

Unit	Open Season	Bag Limit
Unit 12	1 Sep-31 May	1 bear

A bear taken in this unit 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. No regulatory changes for grizzly bears in Unit 12 occurred during the report period. Grizzly bear regulations were liberalized in northern Unit 20D to 1 bear per year in 1992 which could affect the grizzly bear numbers in adjacent Unit 12.

Hunter Harvest. During the 1993-1994 regulatory year, hunters reported taking 18 bears (11 males, 7 females), slightly higher than the 5-year average of 16 bears (Table 1). Reported mean annual harvests of 12.5 bears from 1988 through 1991 increased to 24 and 18 during 1992 and 1993, respectively. The increased bear harvest is probably due to the increasing number of moose hunters that began using Unit 12 in 1992. Many of these hunters took grizzly bears incidentally during moose hunting activities.

During 1984-1985 the lack of a trophy tag requirement for Unit 12 influenced the annual bear harvest when 29 and 28 bears, respectively, were reported taken. Before that time, harvest in Unit 12 reached 28 bears only in 1973. After the 1986 Board of Game decision requiring a resident trophy tag for Unit 12 grizzly bear hunters, the harvest declined and has primarily remained within the historic harvest range (10-23).

Hunter Residency and Success. During 1993-1994 harvest by resident hunters accounted for 44% of the grizzly bears taken in Unit 12, compared with the 5-year average of 53% (Table 2). The reduced resident harvest is probably due to a combination of declining bear population due to liberalized harvest regulations in the accessible areas where residents commonly hunt moose and the return to the bag limit of 1 bear every 4 years in 1991. Before the 1 bear/year regulation in 1982, nonresident hunters took 63% of grizzly bears harvested in Unit 12; only 34% were taken between 1982 and 1991 after the regulation was enacted. Of all the regulation liberalizations, the bag limit of 1 bear/year was probably the most responsible for keeping harvests by resident hunters relatively high.

Harvest Chronology. During 1993-1994, 82% of 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 moose and caribou hunters are afield.

Transport Methods. During 1992 and 1993, horses were used by most successful grizzly bear hunters in Unit 12 (Table 4). Historically, airplanes and horses have been used by most successful hunters. Only 3 bears have been harvested by hunters using 3- or 4-wheelers as their primary transportation during the past 7 years.

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 contains good grizzly bear habitat with the exception of about 2500 mi^2 of unvegetated mountaintops and ice fields. Bear habitat has remained relatively undisturbed except for 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 good seasonal salmon runs.

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 primary 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 calf survival also increased in areas that have 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 have not determined if there is a direct relationship between hunter-induced grizzly bear population reductions and moose calf survival.

Before we can determine the validity of the technique, we need to investigate at least the following variables: 1) what level of treatment is necessary to cause an increase in calf survival for different moose densities and environmental conditions; 2) the effects of compensatory predation by the remaining bears or other predators; and 3) how harvest selection affects grizzly bear population composition and the overall predation rates by bears on moose calves. Grizzly bear harvest in Unit 12 and in adjacent Unit 20E is not selective for any sex or age class. If younger bears are not the primary predators on moose calves and are most vulnerable to incidental harvest compared with large males and unaccompanied females, then to cause a bear reduction to benefit moose calf survival, harvest management would have to become more selective.

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 for more bear reduction programs to be initiated. 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. Until we do, we should not justify this program by suggesting it will improve moose and caribou calf survival. At the same time, many Interior areas could sustain the harvest allowed by a 1 bear/year bag limit. Hunter

opportunity could be maximized and a greater proportion of the harvest could be taken by Alaskan residents without jeopardizing the long-term viability of the bear population.

CONCLUSIONS AND RECOMMENDATIONS

Grizzly bears are well-distributed throughout Unit 12, and the unit population is probably stable. The 1993 population estimate was 290 to 426 bears (15.0-22.0 bears of all ages/1000 km^2). Liberal harvest regulations have allowed maximum hunter opportunity and a greater harvest by Alaskan residents; reductions in the number of problem bears around the communities has probably resulted.

Since 1992 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 greater moose calf survival. During the period of liberal regulations, the bear harvest increased and caused local reductions in bear density, but the effects of this program on moose calf survival have not been confirmed.

Before justifying any new regulations for increasing grizzly bear harvest to increase moose calf survival, we need to conduct research on the effects of such management programs in both high and low density moose areas. I recommend we initiate a calf moose mortality study in both Unit 20E and Unit 13. This management technique has been used in Unit 20E since 1981.

LITERATURE CITED

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Table 1 Unit 12 grizzly bear harvest, 1989-1994

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[b]															
Fall 1994	5	6	0	11	1	0	0	0	0	6	(50)	6	(50)	0	12

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

Table 2 Unit 12 grizzly bear successful hunter residency, 1989-1994

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[a]	1	(9)	0	(0)	10	(91)	11

[a] Preliminary harvest.

Table 3 Unit 12 grizzly bear harvest chronology by time period, 1989-1994

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[c]	11	(100)	0	(0)	0	(0)	--	--	--	--	--	--	11

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

Table 4 Unit 12 grizzly bear harvest by transport method, 1989-1994

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[b]	0 (0)	9 (75)	0 (0)	0 (0)	0 (0)	0 (0)	2 (17)	1 (8)	0 (0)	12[a]

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

LOCATION

Game Management Unit: 13 (22,857 mi^2)

Geographical 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.

MANAGEMENT DIRECTION

Management Objectives

To maintain a population of 600-1,200 bears and maintain an average annual harvest of fewer than 25 females with an overall average harvest of fewer than 75 bears.

METHODS

Department representatives sealed skulls and hides of harvested bears. They measured skulls, determined sex, and extracted a premolar tooth for aging. Sealers collected information on date and location of harvest and time spent afield by successful hunters.

RESULTS AND DISCUSSION

Population Status and Trend

Brown bears were probably abundant in Unit 13 before 1948-53 when federal poisoning programs directed at controlling wolves reduced bear numbers. Brown bears were again considered numerous in Unit 13 by the mid-to-late-1970s, and the population was increasing. During this period, Ballard et al. (1980) indicated the unit had high bear densities for an interior area. The bear population probably ceased growing about 1980 when harvest rates increased. Miller (1993) estimated bear numbers were reduced between 23% and 48% since 1980 in Unit 13. He estimated larger declines in Subunits 13E, 13B and 13A, while the population was stable in 13C and 13D.

Population Size: A population estimate during the late 1970s was approximately 1,500 brown bears. In 1979 a density estimate was obtained during a brown bear transplant along the upper Susitna River in Subunits 13B and 13E. The resulting estimate was 1 bear/16 mi^2 and 1 bear $\geq$2.0 years of age/30 mi^2 (Ballard et al. 1982, Miller 1988). A second density estimate of 1 bear/13.8 mi^2 (1 bear $\geq$2.0 years/20.2 mi^2) was obtained in 1985 in an adjacent area near the Susitna River (Miller 1987) in Subunit 13E.

In 1987 another density estimate was completed for a portion of the upper Susitna River to determine if bear numbers had changed since 1979 (Miller 1988). Density of 1 bear/35 mi^2 (1 bear $\geq$2.0 years/55 mi^2) indicated the density in the upper Susitna was roughly one-half that of 1979's. We applied the 1985 and 1987 density estimates to the remainder of Unit 13, using a subjective stratification of the unit, resulting in a preliminary population estimate of 1,228 brown bears, of which 823 were $\geq$2.0 years-of-age (Miller 1990b). Additional methods of estimating population size from harvest data were attempted. Based on a sustainable harvest rate model, 640-1,120 bears were estimated to inhabit Unit 13 (Miller 1993). A second density estimate for the 1985 study area will be completed in 1995. A comparison of density estimates over this 10-year interval will be possible, providing overall population trends.

Population Composition: Miller (1993) reported that during 1980-1988, brown bear litters averaged 2.1 cubs-of-the-year, 1.9 yearlings, and 1.8 two-year-olds. The estimated reproductive interval was 4.1 years, and the observed age at first reproduction was 5.6 years (range = 4-9). Based on these reproductive parameters, the brown bear population in Unit 13 has a typical reproductive potential for an interior population, similar to that found north of the Alaska Range (Reynolds 1993).

Distribution and Movements: Miller (1987), using minimum convex polygons, reported average home range estimates of 749 mi^2 for males and 193 mi^2 for females. He, as well as Reynolds (1993), noted a pattern of subadult dispersal, when 2- or 3-year-old males emigrated from the home range of their mother. Female offspring showed little dispersal and usually stayed in maternal home ranges. After den emergence, most bears, except females with cubs-of-the-year (COYs), move down to river bottoms to feed on sprouting plants and overwintered berries and to scavenge carcasses of ungulates that died during winter. Females with COYs remained at higher elevations and minimized contact with other bears. Miller also reported movements that may have been influenced by caribou and moose calving and by the seasonal presence of salmon in streams. Spraker et al. (1981) and Ballard et al. (1982) reported additional information on movements and home ranges of bears radiocollared for research projects in Unit 13.

Mortality

Harvest:

Season and Bag Limit: Between 1990 and 1993 the hunting season in Unit 13 for resident and nonresident hunters was 10 September to 31 May, except Subunit 13D where the season was 1

September to 31 May. The bag limit was 1 bear every 4 regulatory years. The 1993-94 hunting season was 1 September to 31 May in all of Unit 13 except that portion of 13E west of the Alaska Railroad where the season opened on 10 September.

Game Board Actions and Emergency Orders. The Board of Game lengthened the fall brown bear seasons in Unit 13 by 10 days during its spring 1993 meeting. The season opening moved from 10 September to 1 September in all subunits except 13D, which opened 1 September. The season opening for Subunit 13E west of the Alaska Railroad remained 10 September.

During its January 1995 meeting the BOG eliminated the $25 resident tag fee requirement for brown bears in Unit 13 effective 1 July 1995. The board's intention for this action was to increase the brown bear harvest in Unit 13. This was the same justification used by the BOG to lengthen the fall season by 10 days a year earlier. Both these actions encourage the incidental or opportunistic taking of brown bears by moose and caribou hunters.

Hunter Harvest. The reported 1993-94 sport harvest of brown bears was 66. This take was 45 (40%) bears below the 1992-93 harvest of 111. The average take for this 2-year period was 89 bears. The average yearly harvest was 125 bears during the 5-year period, 1982-87, when harvests were the highest because of the liberalized bag limit. The average annual harvest during 1988-92 was 82 bears a year (range = 73-98), following a reduction in the bag limit and season.

The 1993-94 brown bear harvest by subunits included: 13A - 7 bears, 13B - 4, 13C - 7, 13D - 9, and 13E - 31. In all subunits except 13E the reported harvests were well below harvest levels reported from 1984-87. In 13E, although the harvest of 31 bears was well below the high annual harvest of 45 bears reported during the 4 peak harvest years from 1984-87, the yearly harvests of 42 bears for each of the previous two years approached the historic high average.

The 1993-94 harvest was 38 (58%) males, and 24 (42%) females (Table 1). Males predominated the harvest in all subunits except 13E, where they composed only 47% of the harvest. The mean skull size was 21.9 inches for males and 20.4 inches for females. The mean age was 5.4 years for males and 8.3 years for females. The mean age of all males taken was lower than the 19-year average of 6.0 years. However, the mean age for the females in the harvest was well above the 19-year average of 7.0 years.

Interpretation of size and age data in the harvest is difficult (Miller 1993). Unit 13 data show a high proportion of the yearly take composed of young males, indicating recruitment and/or immigration into the population. Old bears are taken every year, indicating heavy harvests from previous years have not prevented the older bears from surviving. This is the expected harvest composition pattern from a heavily harvested bear population.

Hunter Residency and Success. Nonresident hunters took 26 (39%) bears in 1993-94 (Table 2). The nonresident harvests between 1989 and 1992 were some of the highest reported in years. Over the past 33 years, nonresident hunters averaged 28 bears a year. Local residents took 5 (8%) bears in 1993-94, and 19 (18%) in 1992-93. Local residents averaged 10 bears a year during this reporting period. Nonlocal Alaskans took 35 (53%) bears, compared with an average of 57 bears

a year between 1985-91. Successful hunters averaged 4.2 days in the field to take a bear in 1993-94 and 3.3 in 1992-93. The effort in 1992-93 was the lowest ever reported. Nonresidents spent more time hunting than residents, averaging 5.3 days hunting compared with only 3.6 days for residents. Except for a few unusual circumstances such as low hunter effort in 1992 due to increased vulnerability of bears, hunter effort data does not exhibit any discernible trend. The fall of 1992 had especially low hunter effort as it only took an average of 2.9 days to take a bear compared with 3.9 days in 1993. During the fall of 1992, deep snow and record cold occurred in early September and the weather never moderated. This early onset of winter made bears more vulnerable during moose and caribou season. Early winter conditions disrupted feeding habits, and snow cover increased the visibility of bears to hunters.

Harvest Chronology. Hunters harvested 42 (64%) bears during the fall of 1993 and 24 (36%) animals spring of 1994 (Table 3). Males composed 46% (19) and 79% (19) of the fall and spring harvests, respectively. Except for spring harvests in 1990 and 1991, fall harvests usually exceeded the spring take. During the fall most of the harvest occurs early September when moose and caribou seasons are also open. Historically, the spring chronology data indicated more bears were taken during May, but since 1989 April has had a much higher reported kill figure than May. During spring seasons, the percentage of females taken increases through the season, and often during the last week more females than males may be taken (Miller 1990*a*). The total number of bears taken late in the spring season, however, is usually low because snow melt and breakup limit hunter access. The potential for overharvesting females is greater in the fall because more hunters are afield as hunting seasons are open for other species. These hunters may be more likely to take the first legal bear they see. Historically, the percentage of females is greater than males in the harvest during the first 10 days of the bear season in September. During the period of high harvests from 1984-87, females averaged 54% of the fall harvests. In 1993 and 1994, 32% (n = 12) and 34% (n = 18) (preliminary) of the fall take occurred during the 9-day extension (1-9 Sept.) of the fall season established in 1993 by the BOG.

Transport Methods. Aircraft were the most important method of transportation in Unit 13, followed by 4-wheelers and snowmachines (Table 4). Historically, aircraft has been the most important method of transportation. Snowmachines increased in use about 1989 when design changes made snowmachines more powerful and reliable, giving hunters potential to travel into areas formerly too rough or remote for older snowmachines. Also, snowfall over the past 6 years has been especially heavy, resulting in excellent travel conditions during the early portions of the spring season. The increased use of snowmachines coincides with chronology data that shows increased bear harvests during the month of April. The importance of 4-wheelers as a transportation method has risen during the last 2 years. They are especially popular with caribou and moose hunters during early fall seasons. Unit 13 provides many areas with extensive trail systems ideally suited to 4-wheeler transportation during fall season.

Other Mortality: An average of 2.8 bears per year (n = 93) were killed in Unit 13 in defense of life or property (DLP) since 1961. Two DLP bears were taken during 1993-94. DLP killings were higher between 1990 and 1993, averaging 5 per year for this 3-year period. Reasons for this increase are unknown. The reported DLP harvest is considered a minimum estimate, as some bears were shot and not reported, especially at remote cabins, homesites and mining claims. The

state requirement to salvage the hide often deters individuals from reporting DLP bears because of the required effort. Also, bears are not reported because individuals may be cited if their DLP claim is not valid.

Miller (1990*b*) reported average natural mortality rates of 33% for cubs-of-the-year and 16% for yearlings during 1978-1989. He also documented intraspecific predation by brown bears as a source of natural mortality, especially in cubs and yearlings. However, Miller (1990*c*) concluded there was not evidence of an increase in cub survivorship in portions of Unit 13 where densities of adult males were reduced because of increased harvests. Reynolds (1993) reached similar conclusions.

Mortality rates for 104 radiocollared or marked brown bears from 1980-1992 were reported by Miller (1993). Annual harvest rates for marked bears ranged from 3-17% and averaged 8%. The annual harvest rate for females in a declining population in the northcentral Alaska Range was 10.4% (Reynolds 1993).

Habitat

Assessment: Bears monitored near Valdez Creek avoided the large mining operation in that area (Miller 1988). Development in remote areas in Unit 13 could reduce brown bear habitat in the unit. Also, more bears are reported killed in DLP situations at remote sites (33%) than are reported for any other site category (Miller and Chihuly 1987). The number of remote cabins and homesites in Unit 13 has increased substantially over the past 15 years. A continuing increase in the number of remote cabins will adversely affect brown bears in Unit 13.

Nonregulatory Management Problems/Needs

An important brown bear management problem is the divergent public attitude concerning brown bears. A segment of the population likes to view brown bears and favors management objectives that would provide a large number of bears. In contrast, some of the public, especially local residents, do not like living near bears. These individuals have usually experienced property damage, fatality of pets or livestock, or fear personal injury. Publications encourage and maintain the public's fear of bears. Frequent "scare" articles in the media perpetuate bear/human conflicts.

The bear/human problem was elevated in early 1992 when a woman was killed and partially consumed by a black bear at her cabin in Subunit 13A. The fear of all bears increased substantially and caused an increase in bear complaints to ADF&G. Rumors of unreported shootings and wounded or killed bears increased, but no bear kills were documented during the 2-4 week period of hysteria that followed this incident.

In dealing with bear/human conflicts at remote sites, I recommend the department maintain its policy of not killing or relocating problem bears. 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 partially developed areas, especially along the road system where bear/human conflicts are frequent.

CONCLUSIONS AND RECOMMENDATIONS

A major brown bear management problem is the difficulty in obtaining population estimates. Because of their low density and secretive behavior, bears are very difficult to spot and count. This is especially true of interior grizzly populations that do not congregate on salmon streams and are wary of motorized vehicles. In most units counts have never been conducted because of the cost. Population estimates for Unit 13 are based on unitwide extrapolations of measured bear density in small study areas. Density estimates were obtained on 2 adjacent study areas during 3 population estimation attempts over a 9-year period between 1979-1987. One study area was censused twice and thus provided trend data. A second density estimate for the other study area will be completed during May 1995. This will provide additional trend data. Confidence intervals obtained during the 2 already completed surveys indicated estimates varied from exhibiting no change in bear numbers to a 50% decline. The fact that human harvests have been very high on the study area supports the conclusion of a substantial decline. However, gold mining activity increased between the study periods and could have contributed to the decline. Current density estimates are based on field data and their use in extrapolating a unitwide bear estimate is justified. Caution is needed, however, when using density estimates in a small area to infer population estimates in a large area. Current population estimates of between 600 and 1200 bears reflect this uncertainty.

The public, especially Unit 13 residents involved with Fish and Game advisory committees, does not believe ADF&G estimates of the Unit 13 brown bear population or trend. They feel bear numbers are increasing, not declining, and there are more brown bears than 10 or 15 years ago. In line with these opinions, local advisory committees continue to propose hunting regulations that increase the season length and bag limits and eliminate the bear tag fee for residents. Local residents feel bear numbers can withstand additional harvests, bears should be reduced (especially around developed areas), and if the numbers of brown bears were reduced, moose calf survivorship would improve.

Between 1980 and 1987 hunting seasons and bag limits were liberalized to increase bear harvests. The objective of the BOG was to reduce brown bear numbers in Unit 13. 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). Miller (1993) concluded bear harvests had caused a significant decline in the Unit 13 bear population.

Hunting regulations became more restrictive when the management objective of maintaining a stable brown bear population was adopted in 1987. With a population estimate of 1,200 bears in 1987, the sustainable harvest rate was 70 bears. A maximum sustainable harvest rate for brown bears in Unit 13 is estimated at 5.7% per year (8% for bears $\geq$2.0 years) (Miller 1988). The number of old ($\geq$5 years) females in the harvest is of particular importance and should be maintained at a low level estimated to be less than 30 adult females a year. The average harvest since 1987 has been 84 bears a year, exceeding the calculated sustainable rate by an average of 14 bears a year. Assuming the population estimate approximated actual bear numbers, the obvious

conclusion is the sport harvest could have caused a decline in the Unit 13 bear population, even with the reduction in season dates and bag limits in effect between 1987 and 1994.

The problem with using these calculated sustainable harvest rates as a means of determining population trends is the assumption the population was closed and recruitment was only from reproduction. The Unit 13 brown bear population is not a closed population. Brown bears are fully or partially protected in both Denali National Park and Wrangell St. Elias National Park. These parks are adjacent to Unit 13 and may provide a source of immigrants. Also, bear kills were plotted based upon reported kill locations. Although many kill sites were in more open and heavily hunted areas, they bordered areas lightly hunted or closed to hunting. This supports the conclusion that bears are immigrating into heavily harvested areas. I believe immigration was not great enough to have prevented a population decline under prior (1984-87) harvest levels. The importance of immigrants increases, however, as harvests decline and we approach the sustainable harvest estimate for Unit 13.

Additional harvest indicators suggesting a decline in bear densities in Unit 13 were presented by Miller (1993). He discussed why a decrease in the percentage of males and ages of males taken in the fall suggested a declining population. An increase in the number of females harvested and the percentage of females in the harvest was also observed. These patterns were evident after a period of high harvests in the late 1980s, supporting the conclusion that bear numbers had indeed been reduced during the 1980-87 period. However, in recent years this trend has not been observed every year. Specifically, the percentage males in the harvest, including the fall, has increased. The age of the males taken has also increased in some years with more males $\geq$5 years old taken between 1991 and 1993 than during the periods of high harvests. A higher percentage of older males in the harvest is not expected from a heavily exploited population.

Effort data does not support the conclusion the bear population has been greatly reduced. There is not an evident trend indicating it takes more time for successful hunters to harvest a brown bear in Unit 13. As bear numbers decline, the obvious expectation is that it would take longer to find a bear. This has not been observed. Unfortunately, the lack of data on number of unsuccessful hunters and their effort precludes complete analysis of trends in hunter effort. I recommend we begin to collect effort data for unsuccessful hunters.

Miller (1993) provided very important harvest data inconsistent with the conclusion that the Unit 13 bear population has been reduced. He reported the harvest rate for all marked bears $\geq$2 years was 8% during his study. The allowable harvest rate for bears $\geq$2 years old was calculated at 8%, thus, the observed harvest rate for marked bears was identical to the allowable harvest. This was an important finding because most of these bears were marked in the upper Susitna study areas in Subunit 13E where harvest rates and hunting pressure have been the highest. Elsewhere in Unit 13 the harvest rates have been lower.

It is not clear what the effect of hunting mortality was on the brown bear population in Unit 13 between 1987 and 1994. In some years with lower harvests, we may have approached our estimated sustainable harvest level. Overall harvests between 1987 and 1994 exceeded calculated sustainable levels. This is especially true in Subunit 13E where yearly harvests continue to exceed

all estimates of sustainable harvest rates. If the assumptions concerning the population estimate and sustainable harvest rates were correct, the logical conclusion is that bear numbers continued to decline, at least in some subunits such as 13E during this period. If, however, immigration increased production or survival occurred and contributed more bears to the Unit 13 population than calculated, bear harvests at the 1987-94 level may not have resulted in additional population declines unitwide.

Current management objectives for brown bears in Unit 13 became obsolete after the BOG extended the fall season in 1993 and eliminated the tag fee requirements for resident hunters in January 1995. Because of these actions, brown bears in Unit 13 will be subjected to the heaviest hunting pressure ever exerted on a bear population in Alaska, beginning with the fall 1995 season. Because resident hunters will not have to buy a tag before going into the field, any moose or caribou hunter can kill a bear if they see one. Since bear season coincides with most of moose season and the second half of caribou season, many of the 5,000 plus moose hunters and 7-10,000 caribou hunters could also be hunting brown bear. It is hard to believe this action will not result in a substantial increase in the brown bear harvest in Unit 13.

Based on currently available population estimates and previously calculated sustainable harvest rates, a large increase in the brown bear harvest will result in a population decline. Liberalized hunting regulations passed by the Board of Game show the intent of the Board to change the management objective for brown bears in the unit from maintaining a stable population to reducing the population. The BOG now needs to determine guidelines to implement this new management objective for brown bears in Unit 13. They should state what percent population reduction they hope to achieve, or what increase in the brown bear harvest is acceptable, and for how many years they will allow high harvests.

Any specific management recommendations are premature at this time until we receive direction from the BOG as to management guidelines. It will also be necessary to see just what harvests are obtained this fall. Also, the density estimate and trend data expected in May 1995 will affect population status and trend figures.

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Table 1. Unit 13 brown bear harvest, 1989-94.

Regulatory year	Hunter Kill						Nonhunting kill[a]			Total estimated kill					
	M	(%)	F	(%)	Unk.	Total	M	F	Unk.	M	(%)	F	(%)	Unk.	Total
1989-90															
Fall 89	25	(54)	21	(46)	6	52	--	--	--	25	(54)	21	(46)	6	52
Spring 90	30	(68)	14	(32)	2	46	--	--	--	30	(68)	14	(32)	2	46
Total	55	(61)	35	(39)	8	98	1	0	0	56	(62)	35	(38)	8	99
1990-91															
Fall 90	22	(65)	12	(35)	3	37	--	--	--	22	(65)	12	(35)	3	37
Spring 91	35	(78)	10	(22)	3	48	--	--	--	35	(78)	10	(22)	3	48
Total	57	(72)	22	(28)	6	85	4	0	1	61	(73)	22	(27)	7	90
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	0	40	(60)	27	(40)	1	68

[a]Includes defense of life or property kills, research mortalities, and other known human-caused accidental mortality.
[b]Estimates not made because of a lack of supporting data.

Table 2. Unit 13 brown bear successful hunter residency, 1989-94.

Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total successful hunters
1989-90	12	(12)	49	(50)	37	(38)	98
1990-91	12	(14)	38	(45)	35	(41)	85
1991-92	4	(5)	34	(45)	37	(49)	75
1992-93	19	(18)	56	(52)	33	(30)	111
1993-94	5	(8)	35	(53)	26	(39)	66

[a] Local resident means resident of Unit 13.

Table 3. Unit 13 brown bear harvest chronology percent by time period, 1989-94.

Regulatory year	Harvest periods: September %	(n)	October %	(n)	November %	(n)	April %	(n)	May %	(n)	*n*
1989-90	50	(49)	3	(3)	--	--	32	(31)	15	(15)	98
1990-91	37	(31)	7	(6)	--	--	29	(25)	27	(23)	85
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)	13	(9)	66

Table 4. Unit 13 brown bear harvest percent by transport method, 1989-94.

Regulatory year	Percent of harvest									
	Airplane	Horse	Boat	3 or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Walk	Unk.	*n*
1989-90	29	10	4	1	17	17	12	1	8	98
1990-91	35	3	1	4	17	13	14	8	5	85
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	10	6	0	66

LOCATION

Game Management Unit: 14 (6,625 mi^2)

Geographic Description: Upper Cook Inlet

BACKGROUND

Brown bear distribution and abundance has been affected in much of Unit 14 by urbanization, agricultural development and remote settlement. Harkness (1993) subjectively estimated the Unit 14 brown bear population at 217 (range = 185-239) by extrapolating from measured densities within adjacent Unit 13. Although this extrapolation technique was the best available, it may have resulted in substantial error. Griese (1993) and Harkness (1993) concluded that during 1985-91 recorded mortality numbers were high in respect to estimated sustainable levels. Both agreed a shorter fall hunting season was necessary as a conservative management strategy. In spring 1992 the Board of Game adopted a fall hunting season, which was shorter by 14 days.

Total annual reported brown bear mortalities for the period 1985-1991 averaged 13.6 (range 7-18) bears. Hunter take averaged 11.1 (range 7-15) bears during this period. An average of 2.4 (range 0-6) bears died annually due to human causes other than hunting. Female bears composed 40% of mortalities of known sex.

MANAGEMENT DIRECTION

Management Goals

In Subunit 14A the 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 the maximum opportunity to participate in hunting brown bears. 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 or equal to 3 years-of-age.

METHODS

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

RESULTS AND DISCUSSION

Population Status and Trend

No fieldwork was scheduled during this period, but based on increasing rates of nonhunting mortalities and growing numbers of mortalities by hunters, bear numbers seem stable or possibly increasing. The segment of the population using Chugach State Park and Fort Richardson in Subunit 14C has increased in recent years.

Mortality

Harvest:

Season and Bag Limit. The brown bear hunting season for resident and nonresident hunters, was 15 September to 10 October and 1 May to 25 May. The bag limit in Unit 14 was 1 bear every 4 regulatory years. Harvesting cubs or females accompanied by cubs was prohibited.

Game Board Actions and Emergency Orders. Since the Board of Game adopted reduced fall seasons and extended spring seasons during April 1992, no further changes have been made.

Hunter Harvest. The 1992-93 reported harvest declined to an average of 8.0 bears, comprised of 3.5 females (Table 1). Females represented 44% of the hunter harvest, and a minimum of 4 females 3-years-of-age or older were taken by hunters, all during 1992. In the previous 3-year period, reported harvest averaged 11.7 (9-13) bears, while females composed 36% of known sex bears. An average of 3.7 (3-5) females 3 years-of-age or older were killed annually during the same 3-year period.

During 1992-93 hunters killed 8 bears in Subunit 14A, 8 in Subunit 14B, and 1 in Subunit 14C.

Hunter Residency and Success. Unit 14 residents continued to account for most of Unit 14 brown bear harvest. Unit residents killed 75% of 16 hunter-killed bears during 1992-93 (Table 2). During the previous 3-year period, residents killed 77% of the hunter harvest.

Harvest Chronology. New opportunities for hunters to take bears during May and reduced fall seasons caused an expected shift in the harvest to the spring. During 1992-93, 44% (7 of 16) of the harvest occurred during May (Table 3). During the previous 3-year period, the spring harvest represented only 8% of the total harvest.

Transport Methods. During 1992-93, hunters favored airplanes, ORVs, 4 wheelers, and highway vehicles (Table 4).

Other Mortality. Five bears were reported killed outside of legal hunter harvest. Three bears were reported killed DLP, and 1 bear was killed by a highway vehicle. One bear was killed illegally. Two of the 3 bears killed DLP and the illegally killed bear were killed in Subunit 14A.

Ages. Yearly mean ages of bears sampled from all mortalities have varied substantially over the past 5 years due to small sample sizes. During the 1992-93 period, the mean age of males ($n = 9$) was 6.6 years and the mean age of females ($n = 6$) was 4.3 years. During the previous 3-year period, the mean age of males ($n = 19$) was 5.9 years and the mean age of females (n=12) was 5.3 years. Only 9 of 48 total bears sampled since 1989 have reached or exceeded 10 years-of-age; only 2 reached or exceeded 20 years-of-age.

CONCLUSIONS AND RECOMMENDATIONS

Recent changes to the brown bear hunting seasons in Unit 14 have potential for effecting future population and human use objectives. Reduced hunter harvest during 1992-93 reflected a trend for a bear harvest within human use objectives. The mean harvest of 8 bears meets the objective of 6-10 bears. However, the harvest of females exceeded objectives by averaging 3.5 bears, reaching or exceeding 3 years-of-age; the desired maximum harvest of these older females is 3 bears, including nonhunting mortalities. The effects of nonhunting mortalities on the population will be difficult to reduce given the rate of development in the unit.

Evaluation of the effects of the new hunting seasons should be delayed until sample sizes are larger. I propose 5 years of hunter harvest data be collected under this season framework before we consider changes to seasons and bag limits.

Brown bear trend counts have not been conducted in Unit 14. Cost, extensive human development, diverse habitat, low density bear populations and numerous other high priority areas will likely preclude trend counts in the near future. Identifying moderate fluctuations in bear densities in the future will be highly subjective.

High levels of human-caused mortality outside of hunting will remain a problem in this most densely human-populated area of the state. The combination of a large semi-wilderness park (Chugach State Park) where bears are protected and a myriad of attractions to bears within the settled areas will continue to result in bear deaths. Livestock and garbage management, frequently responsible for attracting bears into DLP situations, can be stressed in education programs, but even widespread education efforts are unlikely to eliminate this brown bear mortality. I recommend the department encourage state and local government bodies to adopt stricter garbage and livestock management codes which reduce the potential to attract bears into close contact with humans.

In years where human life is lost to bears of any species, nonhunting mortality should be expected to increase in response to elevated fears and news media attention. Such was the case during summer 1993 when "bearanoia" (Anchorage Daily News) increased after 2 humans lost their lives in separate bear attacks. While I believe the department has the ability to assist in designing a "bear primer" course for all residents of Alaska, I believe we are ill equipped to reach enough people to make a difference. I recommend the department include "bear facts" in the state fishing regulations, as a step in reaching more people apt to come in contact with bears.

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Table 1. Unit 14 brown bear harvest, 1989-94.

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
1989															
Fall 89	6	4	(40)	2	12	0	0	1	1	6	(60)	4	(40)	4	14
Spring 90	0	1	(100)	0	1	0	1	0	0	0	(00)	2	(100)	0	2
Total	6	5	(45)	2	13	0	1	1	1	6	(50)	6	950)	4	16
1990															
Fall 90	7	1	(13)	0	8	1	2	1	1	8	(73)	3	(27)	1	13
Spring 91	0	1	(100)	0	1	2	0	0	0	2	(67)	1	(33)	0	3
Total	7	2	(22)	0	9	3	2	1	1	10	(71)	4	(29)	2	16
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

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

Table 2. Unit 14 brown bear successful hunter residency, 1989-93.

Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total successful hunters
1989	10	(77)	0	(0)	3	(23)	13
1990	8	(89)	0	(0)	1	(11)	9
1991	9	(69)	0	(0)	4	(31)	13
1992	7	(64)	0	(0)	4	(36)	11
1993	5	(100)	0	(0)	0	(0)	5

[a]Unit 14 residents

Table 3. Unit 14 brown bear harvest chronology percent by time period, 1989-93.

Regulatory year	Harvest periods						
	September		October		May		
	1-15	16-30	1-15	16-31	1-15	16-31	*n*
1989	31	38	8	15	0	8	13
1990	56	11	11	11	0	11	9
1991	46	31	15	0	0	8	13
1992	9	55	0	0	18	18	11
1993	0	40	0	0	40	20	5

Table 4. Unit 14 brown bear harvest percent by transport method, 1989-93.

Regulatory year	Percent of harvest						n
	Airplane	Horse	Boat	ORV	Highway vehicle	Other/ Unknown	
1989	17	17	8	17	17	25	12
1990	0	11	11	33	33	11	9
1991	38	8	8	15	15	15	13
1992	36	0	9	8	18	18	11
1993	0	0	0	40	20	40	5

LOCATION

Game Management Unit: 16 (12,255 mi^2)

Geographical Description: West side of Cook Inlet

BACKGROUND

The size or density of the brown bear population in Unit 16 is unknown. Brown bears inhabit most of Unit 16, except Kalgin Island. Faro (1990) suspected highest densities were in the foothills of the Alaska Range. Lacking surveys or censuses, biologists have tracked population trends through hunter harvest statistics.

Area biologists analyzed harvest data and concluded that liberalized bear hunting seasons, beginning in 1985, caused reduced densities of brown bears. Faro (1990) identified decreasing average age of bears as evidence that increased harvests reduced population densities in areas readily accessible to hunters. Griese (1991) believed a declining population hypothesis was supported by 1) a substantial decline in the fall harvest, 2) an increase in number of hunting days required to harvest a bear, and 3) subtle declines in ages and skull sizes of fall male bears.

MANAGEMENT DIRECTION

Management Goals

To allow a sustainable harvest of bears while retaining a desirable predator/prey ratio.

Population Objective

To maintain a brown bear population which appears to be stable or declining slightly.

Human Use Objective

To allow optimum opportunity to hunt brown bears while allowing a 3-year-average harvest of 50-60 bears including an average of 18 females >2-years-old.

METHODS

Biologists monitored brown bear harvests by sealing skulls and hides of harvested brown bears. Department personnel measured skulls, determined sex of bears, extracted a premolar tooth for aging, and recorded date and location of kill and hunter effort.

Hunter efficiency was evaluated by comparing the average number of days afield by successful bear hunters.

Area biologists analyzed harvest data and concluded liberalized bear hunting seasons, beginning in 1985, caused reduced densities of brown bears by substantially increasing annual harvest (Figure 1). Faro (1990) identified decreasing average age of bears as evidence that increased harvests reduced population densities in areas readily accessible to hunters. I (1991) believed a declining population hypothesis was also supported by 1) a substantial decline in the fall harvest, 2) an increase in number of hunting days required to harvest a bear, and 3) subtle declines in ages and skull sizes of fall male bears.

I (1993) estimated the brown bear population at 820 (range = 586-1,156) by subjectively projecting variable bear densities across bear habitat in the unit. Densities were estimated to be intermediate to measured densities in adjacent units (Dean 1987, Miller et al. 1987, Miller and Sellers 1992). I recommended maximum allowable harvest levels of 55 total bears with no more than 18 being females >2 years of age. The desired effect of these harvest ceilings was population recovery. To limit harvest to objective levels, I (1993) recommended a bear season of September 15-May 25.

RESULTS AND DISCUSSION

Population Status and Trend

A declining trend in mean age of bears harvested may indciate a declining population. While some harvest characteristics, previously cited as possible indicators of a declining population trend (Griese 1993) wavered during 1992-93, mean age of both male (Table 3) and female (Table 4) bears continued to decline. Harvests during 1992-93 occurred predominantly during September (47%) and April (32%) (Table 6), which has been typical for the unit.

Population Size: The brown bear population in Unit 16 was previously estimated at 820 (range = 586-1,156) (Griese 1993).

Mortality

Estimated annual mortality for the years 1992-93 averaged 64.5 bears. This estimate included 9.0 bears in Subunit 16A (Table 1) and 55.5 bears in Subunit 16B (Table 2). Annual estimated mortality was 8% of the population estimate (6-11% of the range of estimates).

Average mortality for 1992-93 included 2 females >2-years-old in Subunit 16A and 13 females >2-years-old in Subunit 16B.

Total annual female harvest during the 1992 regulatory year was equivalent to previous peaks in female harvest during 1985 and 1987 (Figure 1). Notably, the harvest of female bears in those

years was also equivalent to or exceeded the total bear harvest before season liberalization in 1985.

Harvest:

Season and Bag Limit. The open hunting season for brown bears in Unit 16 for resident and nonresident hunters was from 1 September to 25 May. The bag limit was 1 bear every 4 regulatory years.

Game Board Actions and Emergency Orders. In March 1994 the Board considered but denied a proposed reduction in the fall brown bear season length. The department proposed a season of September 15-May 25. The season reduction was expected to reduce total harvest by up to 30% and female harvest by up to 42%, thereby encouraging population recovery. However, the Board determined that moose was the priority species in Unit 16 and because high brown bear densities could conflict with that priority, brown bear densities should be allowed to decline.

Hunter Harvest. The number of hunter-killed bears in Unit 16 reached the lowest level since season length liberalization in 1985. Though the combined hunter harvest of Subunit 16A (Table 1) and Subunit 16B (Table 2) reached high levels (77) during 1992, the decline to 40 bears during 1993 was lower than the previous low of 55 bears reported harvested during 1990.

The low harvest during 1993 reflected in part poor spring weather conditions (soft deep snow, frequent snow storms, and several consecutive low visibility days) not conducive to high hunter success. However, fall 1993 harvest was also at it lowest level (20) since 1985. Reduced presence in the field by hunters due to restrictive moose hunting regulations may have been partly responsible.

Hunter harvest averaged 57.5 bears during 1992-93.

Hunter efficiency in the fall increased in Subunit 16B. The 1992-93 average was 5.7 days (n = 58), less than the 1985-89 average of 5.9 days (n =188) and less than the 1990-91 average of 6.58 (n = 53) days (Griese 1993).

Evaluation of mean age for males (Table 3) and females (Table 4) for 1985-93 indicated increased preponderance of younger age bears in the harvest. The mean age of males during 1992-93 (6.2 years, n = 70) was less than the 1990-91 mean of 7.3 years (n = 78) and the 1985-89 mean of 7.8 years (n = 218). Likewise, the mean age of females declined from 7.1 years (n = 116) to 6.6 years (n = 36) to 5.1 years (n = 40).

Hunter Residency and Success. The number of bears harvested by nonresident hunters remained in the range of 30-40, while in 1993 harvest by resident and local hunters declined to 10 bears, which was 29-55% of the previous 4-year harvest (Table 5).

Harvest Chronology. Brown bears inhabit most of Unit 16, except Kalgin Island; however, the size or density of the brown bear population has not been measured. Faro (1990) suspected

highest densities were in the foothills of the Alaska Range. Lacking surveys or censuses, biologists have tracked population trends through bear harvest statistics.

Transport Methods. Hunters who used aircraft accounted for 77% of the total harvest during 1992-93 (Table 7), while use of snowmachines, which represented a combined 3% of the 1992-93 harvest, was down slightly from 1990-91.

Other Mortality: An average of 3.0 bears killed in defense of life or property (DLP) during 1992-93 in Unit 16 represented an increase from the previous 5-year average of 1.6 bears.

I estimated the unreported harvest of bears in Unit 16 was equivalent to 5% of the reported kill (Tables 2 and 3). The unreported kill may have been underestimated.

CONCLUSIONS AND RECOMMENDATIONS

Recent actions by the Board of Game, which essentially assigned brown bears to a subordinate status behind moose in Unit 16, diminished the opportunity to manage the bear harvest at sustainable levels. Reaching sustainable harvest levels for the estimated population level could have been attained by a reduction in fall season length. Though the specific population objective was not clearly outlined by the Board, its actions not to reduce harvest clearly implied brown bear numbers would be allowed to decline. The acceptable degree of decline was not specified.

Harvests during this period indicated the newly implied management objectives were achieved. The total estimated brown bear mortality during the most recent 3-year period, 1991-93, averaged 68.3 bears, well above the estimated sustainable level of 50-60 bears. Mortality of females, age >2-years-old, during 1991-93 averaged 18 bears, reaching objective levels.

Annual bear mortality since season liberalization in 1985 has declined (Figure 1), indicating brown bear population has also declined. A decline in the mean ages of harvested bears also reflected reduced availability of older bears.

The opportunity for the public to participate in setting priorities for species objectives in Unit 16 may have been missed in the Board process. Though limited public comment may have been opposed to season restrictions for Unit 16 brown bears, the opportunity to solicit a clear management direction from the interested public was lost. A public planning process that produces species priority and population objectives for all Unit 16 game species is needed.

I recommend the following course of action:

1. Outline a public planning process including timeline, costs, methods and participants, and solicit funding.

2. I strongly recommend research staff strive to develop affordable survey or census methods which provide adequate population trend data to support harvest strategies. The alternative is to budget for a Miller et al. (1987) census.

3. To acquire more meaningful information on hunter effort (Griese 1991), I recommend the initiation of mandatory hunter reporting for all brown bear hunters.

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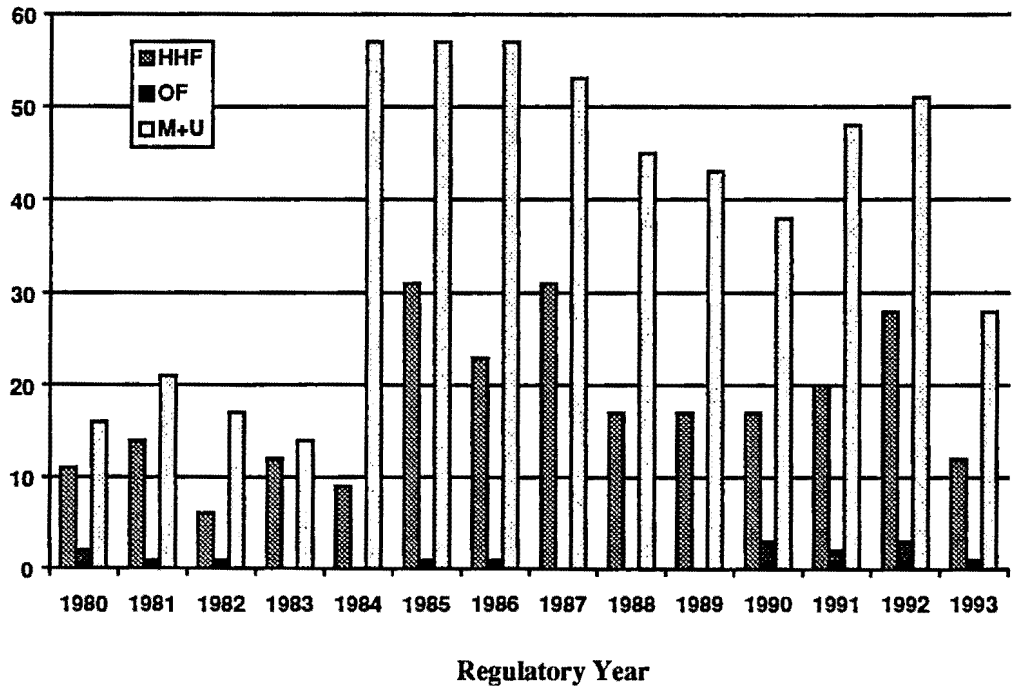

Figure 1. Unit 16 annual reported brown bear mortality, depicting hunter-harvested females (HHF), all other reported female mortality (OF), and all reported male and unknown sex mortality (M+U), 1980-1993.

Table 1. Subunit 16A brown bear harvest, 1989-93.

Regulatory year	Reported							Estimated unreported kill	Total estimated kill			
	Hunter kill				Nonhunting kill[a]							
	M	F (%)	Unk.	Total	M	F	Unk.		M (%)	F (%)	Unk.	Total
1989												
Fall 89	2	2 (50)	1	5	0	0	0	0	2 (50)	2 (50)	1	5
Spring 90	1	0 (0)	0	1	0	0	0	1	1(100)	0 (0)	1	2
Total	3	2 (40)	1	6	0	0	0	1	3 (60)	2 (40)	2	7
1990												
Fall 90	5	2 (29)	1	3	0	0	0	1	5 (71)	2 (29)	2	9
Spring 91	2	1 (33)	0	3	0	0	0	0	2 (67)	1 (33)	0	3
Total	7	3 (30)	1	11	0	0	0	1	7 (70)	3 (30)	2	12
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)	1	13	0	0	0	2	11 (92)	1 (8)	3	15
1992												
Fall 92	3	4 (57)	0	7	1	3	0	1	4(36)	7(64)	0	11
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)	0	16
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

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

Table 2. Subunit 16B brown bear harvest, 1989-93.

Regulatory year	Reported							Estimated unreported kill	Total estimated kill			
	Hunter kill				Nonhunting kill[a]							
	M	F (%)	Unk.	Total	M	F	Unk.		M (%)	F (%)	Unk.	Total
1989												
Fall 89	10	11 (52)	3	24	0	0	0	3	10 (48)	11 (52)	6	27
Spring 90	23	4.(15)	2	29	1	0	0	0	24 (86)	4 (14)	2	30
Total	33	15 (31)	5	53	1	0	0	3	34 (69)	15 (31)	8	57
1990												
Fall 90	14	11 (44)	1	26	0	2	0	2	14 (52)	13 (48)	3	30
Spring 91	15	3 (17)	0	18	0	1	0	1	15 (79)	4 (21)	1	20
Total	29	14 (33)	1	44	0	3	0	3	29 (63)	17 (37)	4	50
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	1	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	1	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

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

Table 3. Unit 16 mean age and skull size of male brown bear harvest, 1985-93.

Regulatory years	Fall				Spring				Total			
	Mean skull size (in)	*n*	Mean age	*n*	Mean skull size (in)	*n*	Mean age	*n*	Mean skull size (in)	*n*	Mean age	*n*
1985-89	21.3	90	5.8	93	24.6	121	9.2	125	23.2	211	7.8	218
1990-91	21.3	36	5.0	35	24.7	43	9.2	43	23.2	79	7.3	78
1992-93	21.3	26	4.0	27	24.1	44	7.4	43	23.1	70	6.2	70

Table 4. Unit 16 age and skull size of female brown bear harvest, 1985-93.

Regulatory years	Fall				Spring				Total			
	Mean skull size (in)	*n*	Mean age	*n*	Mean skull size (in)	*n*	Mean age	*n*	Mean skull size (in)	*n*	Mean age	*n*
1985-89	20.0	93	6.8	93	20.8	23	8.2	23	20.2	116	7.1	116
1990-91	19.5	25	6.8	27	21.1	9	5.9	9	20.0	34	6.6	36
1992-93	19.8	32	5.2	27	20.4	8	5.3	8	19.9	40	5.1	40

Table 5. Unit 16 brown bear successful hunter residency, 1989-93.

Regulatory year	Local[a] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total successful hunters
1989	0	(0)	22	(37)	37	(63)	59
1990	0	(0)	25	(45)	30	(55)	55
1991	1	(1)	32	(48)	34	(51)	67
1992	5	(6)	31	(40)	38	(49)	77
1993	2	(5)	8	(20)	30	(75)	40

[a] Unit 16 residents

Table 6. Unit 16 brown bear harvest chronology percent by time period, 1989-93.

Regulatory year	Harvest periods						
	September %	October %	November %	March %	April %	May %	*n*
1989	41	8	0	2	41	8	59
1990	55	4	4	0	35	4	55
1991	38	10	0	0	40	12	68
1992	49	6	0	1	31	12	77
1993	43	8	0	3	45	3	40

Table 7. Unit 16 brown bear harvest percent by transport method, 1989-93.

Regulatory year	Percent of harvest							
	Airplane %	Horse %	Boat %	Snowmachine %	ORV %	Highway vehicle %	Unknown %	*n*
1989	81	3	3	3	5	0	3	59
1990	80	0	6	6	2	4	4	55
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

LOCATION

Game Management Unit: 17 (18,800 mi^2)

Geographical Description: Northern Bristol Bay

BACKGROUND

Although brown bears are common throughout the northern Bristol Bay area, there have been no research activities 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 and 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, so there has never been as much hunting pressure on this bear population. Annual reported harvests have rarely exceeded 50 bears per year. Before 1970 few bears were reported as harvested from the unit. When the Board of Game established alternate year seasons in Unit 9 in 1973, the number of bear hunters in Unit 17 increased. From 1972-73 to 1980-81, the harvest was generally balanced between the spring and fall seasons. Since then, harvests have been higher during fall seasons than during spring (Figure 1).

One reason for the increase in the fall harvest is increased hunting pressure on the Mulchatna caribou herd as it has nearly quintupled in number during the past decade (Van Daele, in press). Reported moose harvests also increased dramatically during this same period. As more hunters were afield pursuing caribou and moose, they seemed to kill 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 non-hunting mortalities that we either never hear about, or are reported indirectly. Because of the widespread occurrence of these unreported kills, any conclusions based solely on harvest data must be viewed with caution.

MANAGEMENT DIRECTION

Management Objective: Maintain a brown bear population that will sustain an annual harvest of 50 bears comprised of at least 50% males.

METHODS

Each brown bear legally harvested or killed in defense of life or property (DLP) in the unit is sealed. Personnel measure the skull, determine sex, and extract a premolar tooth to determine age. We record data on hunter residency, number of days hunted, date of kill, transportation used, and location of the kill. When possible, we investigate circumstances surrounding DLP and illegal kills. We collect population data during caribou and moose surveys. Reports from fieldworkers are also used to estimate bear population trends.

RESULTS AND DISCUSSION

Population Status and Trend

Unitwide brown bear population is probably stable to increasing. This is the case in most of Subunits 17A and 17C, and the remote portions of 17B. Bears living in portions of Subunit 17B along the Nushagak and Mulchatna rivers experience the greatest harvest pressure. This portion of the bear population may still be declining slightly, but seems to be stabilizing.

Population Size: No population size or density estimates have been made for the brown bear population in Unit 17. Densities seem 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). This would suggest a population estimate of roughly 1350 independent (>2 yrs old) bears in Unit 17.

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

Mortality:

Season and Bag Limit

Subunits 17A & 17C	May 10 - May 25 Sept. 10- Oct. 10	1 bear per 4 regulatory years

Subunit 17B	May 10 - May 25 Sept. 20 - Oct. 10	1 bear per 4 regulatory years
Western Alaska Brown Bear Management Area including 17A and that porton of 17B that drains into Nuyakuk and Tikchik Lakes	Sept. 1 - May 31	1 bear per 4 regulatory years

Game Board Actions and Emergency Orders. During their spring 1992 meetings, 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. A bear tag was not required. Hunters had to salvage the meat and report their kill to the department. Hides and skulls were not required to be sealed if they remained in the unit where they were harvested. No emergency orders were issued during this reporting period.

Harvest:

Hunter Harvest. During the 1993-94 seasons hunters in Unit 17 reported harvesting 33 brown bears, including 21 males (64%), and 12 females (36%)(Table 1). This harvest was lower than the mean annual harvest of the previous 5 years (41.8 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 1993-94 was 21.7" (n = 19) for males and 20.8" (n = 12) for females. Three bears (1 male and 2 females) were killed in Subunit 17A, 22 (16 males, and 6 females) were killed in Subunit 17B, and 8 (4 males and 4 females) were reported from Subunit 17C. In the past 5 yrs, 75% of the bears harvested in the unit have been taken in Subunit 17B, but the number of bears killed in 17B has been steadily declining since 1990-91 (Table 2).

Hunter Residency and Success. Nonresidents account for most of the reported brown bear harvest in Unit 17. During the 1993-94 seasons, nonresidents took 85% of the bears harvested in the unit (Table 3).

Harvest Chronology. Twenty-one bears were killed during the fall 1993 hunting season, and 12 bears were killed during spring 1994. Most bears are harvested in Unit 17 (Table 4) in late September.

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

Other Mortality: Two brown bears were killed in defense of life or property near residences on the Dillingham road system during the 1993-94 regulatory year. A pair of yearling siblings were habitual visitors to homes near town during the summer of 1993. One was shot as it raided a fish

drying rack near a home on Wood River road (1992-93). The other was killed less than a month later when it was breaking into a smokehouse and chasing dogs. The fate of the mother of these yearlings was unknown, but there were unconfirmed reports that she had been shot and killed illegally. Another young bear was shot in September 1993 when it frequented a school bus stop in spite of attempts to scare it away.

Habitat

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

Nonregulatory Problems/Needs

A joint ADF&G/U.S. Fish and Wildlife Service research project was started during the spring of 1992. The objectives of this project are to estimate bear densities, collect baseline population data, and delineate habitat use patterns for brown bears in portions of the Togiak and Yukon Delta National Wildlife Refuges (Unit 18). The project is funded by the U.S. Fish and Wildlife Service (FWS) and was initiated in response to liberalized bear hunting and reporting regulations in the area.

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

There has been an increase in bear/human encounters along the Mulchatna River each year since the fall of 1992. Moose and caribou hunters complain of bears raiding camps and claiming hunter kills in the field. This increase is probably due to a few individual bears that have learned to take advantage of the abundant food provided by the migrating caribou herd and the large number of hunters concentrated on the Mulchatna River corridor. Some bears are also causing problems at sportfishing camps and lodges. These problems can be traced to young bears and/or improper food and garbage storage at the camps.

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 should 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 improve landfills so they are 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 1995 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 met in most years, but the sex ratio of the total bear harvest for the unit is unknown.

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

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

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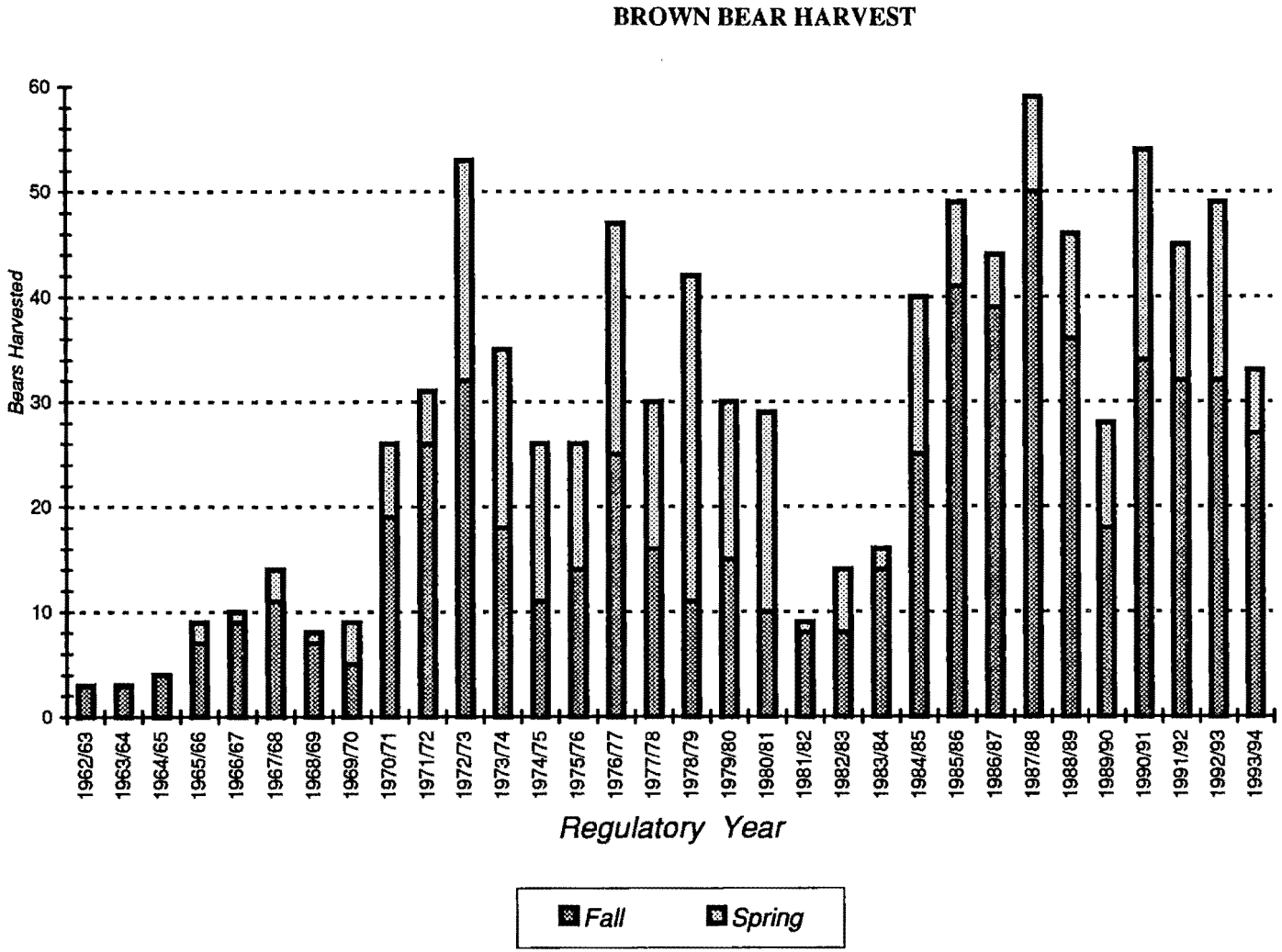

Figure 1. Unit 17 reported brown bear harvest, 1962-63 - 1993-94.

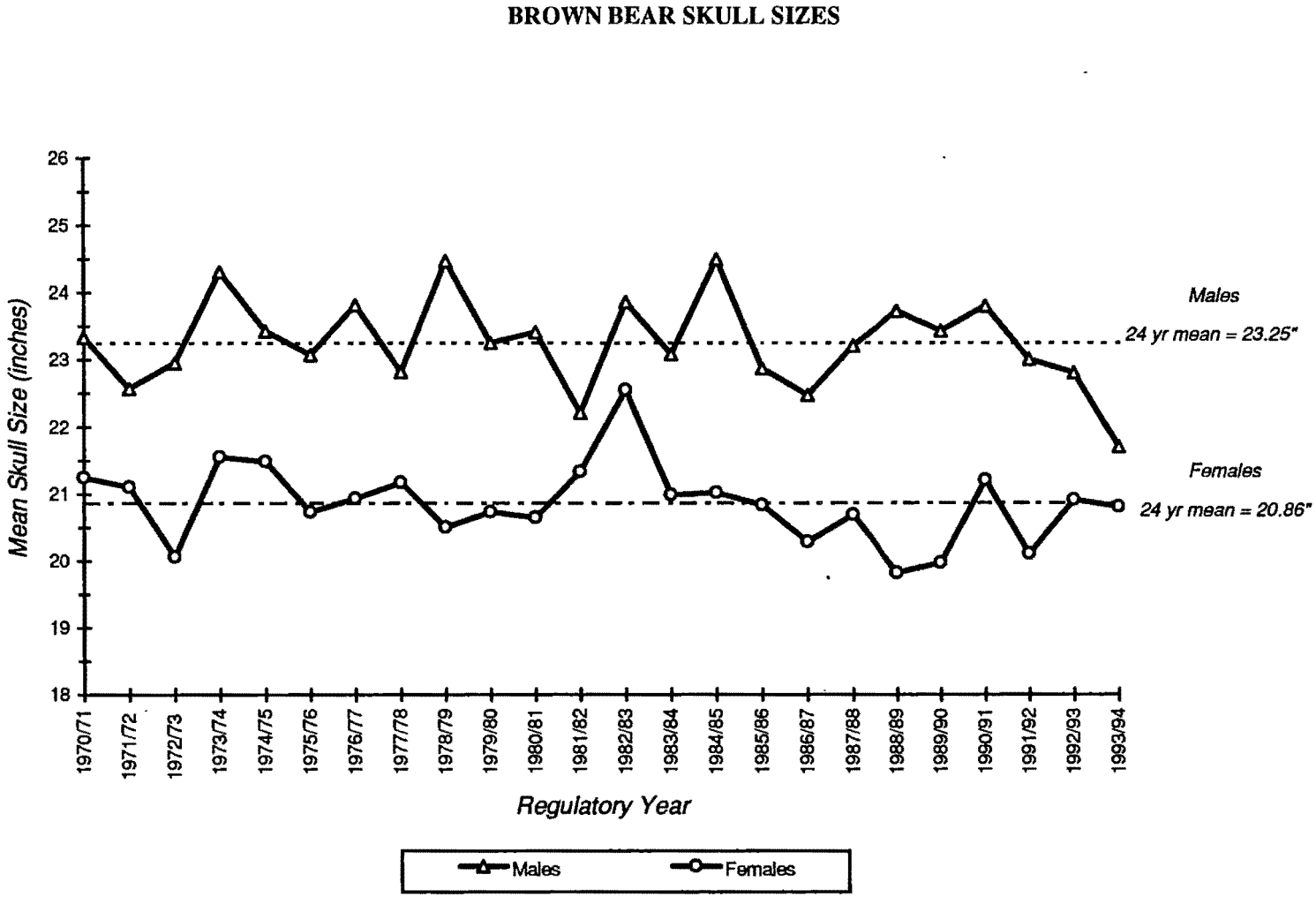

Figure 2. Unit 17 average skull sizes of brown bears, 1970-71 - 1993-94.

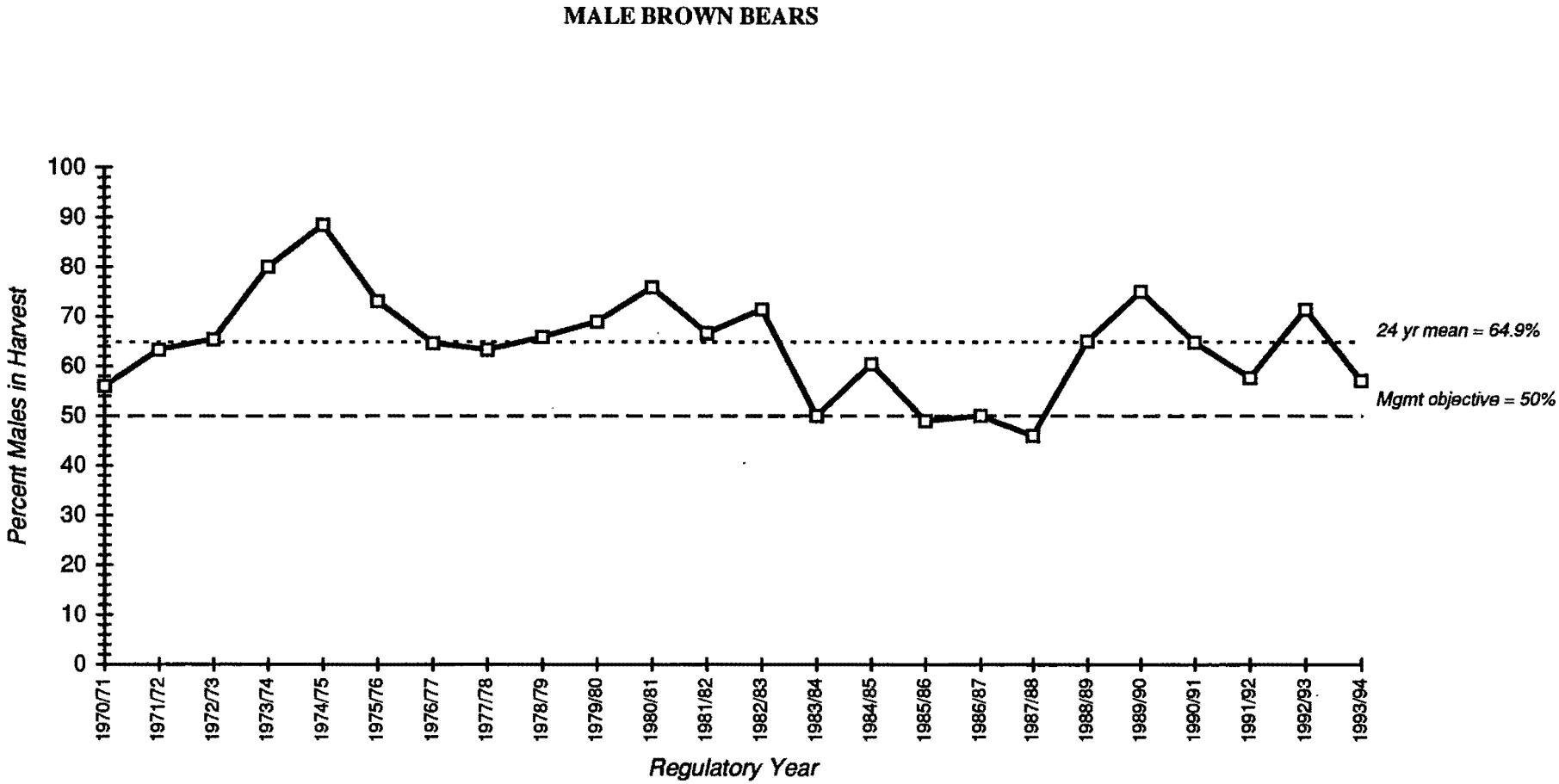

Figure 3. Percentage of male brown bears in the Unit 17 harvest, 1970/71 - 1993/94

Table 1. Unit 17 brown bear harvest, 1989-90 - 1993-94.

Regulatory	Hunter Kill				Nonhunting Kill				Total reported kill			
year	Male	Female	Unk	Total	Male	Female	Unk	Total	Male	Female	Unk	Total
1989												
Fall '89	11	7	0	18	0	0	1	1	11	7	1	19
Spring '90	10	0	0	10	0	0	1	1	10	0	1	11
Total	21	7	0	28	0	0	2	2	21	7	2	30
1990												
Fall '90	18	14	2	34	2	0	1	3	20	14	3	37
Spring '91	17	3	0	20	0	0	0	0	17	3	0	20
Total	35	17	2	54	2	0	1	3	37	17	3	57
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

Table 2. Unit 17 brown bear harvest by subunit, 1989-94.

Regulatory year	Subunit												Unit 17 total			
	17 A				17 B				17 C							
	M	F	Unk	Total	M	F	Unk	Total	M	F	Unk	Total	M	F	Unk	Total
1989/90	1	1	0	2	20	6	0	26	0	0	0	0	21	7	0	28
1990/91	1	3	0	4	33	13	2	48	1	1	0	2	35	17	2	54
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

Table 3. Unit 17 brown bear successful hunter residency, 1989-94.

Regulatory year	Local[a] resident (%)	Nonlocal resident (%)	Nonresident (%)	Total successful hunters[b]
1989/90	0 (----)	3 (10.7)	25 (89.2)	28
1990/91	3 (5.5)	4 (7.4)	47 (87.0)	54
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

[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 time period, 1989-94.

Regulatory year	Spring season				Fall season			Total
	1-15 APR	16-30 APR	1-15 MAY	16-30 MAY	1-15 SEP	16-30 SEP	1-15 OCT	
1989/90[a]	----	----	21.4%	14.3%	3.6%	32.1%	28.6%	28
1990/91[b]	----	----	13.0%	24.1%	1.9%	37.0%	24.1%	54
1991/92[b]	----	----	11.1%	15.6%	6.7%	53.3%	11.1%	45
1992/93[b]	----	----	20.4%	14.3%	12.2%	46.9%	6.1%	49
1993/94[c]	----	----	6.1%	12.1%	9.1%	48.5%	24.2%	33

a - Season dates: Spring - Subunits 17 A & C 10 May -25 May (resident/nonresident)
Subunits 17 A & C 10 Apr - 25 May (subsistence)
Subunits 17 B 10 May -25 May

Fall - Subunits 17A & C 10 Sep - 10 Oct
Subunit 17 B 20 Sep - 10 Oct

b - Season dates: Spring - Unit 17 10 May - 25 May

Fall - Subunits 17A & C 10 Sep - 10 Oct
Subunit 17 B 20 Sep - 10 Oct

c - Season dates for 1993/94 are the same as 1990/91 - 1992/93 with the following addition:
Western Alaska Brown bear Management Area
(including 17A and that portion of 17B that drains into Nuyakuk and Tikchik Lakes) 1 Sep - 31 May

Table 5. Unit 17 brown bear harvest percent by transport method, 1989-94.

Regulatory year	Percent of harvest									Total
	Airplane	Horse	Boat	3 or 4-wheeler	Snowmachine	ORV	Highway vehicle	Walk	Unknown	
1989/90	96.4	---	---	---	---	---	---	---	3.6	28
1990/91	96.3	---	3.7	---	---	---	---	---	---	54
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

LOCATION

Game Management Unit: 18 (42,000 mi^2)

Geographical 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 between the 1983-84 and 1991-92 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 composed of at least 50% males.

Minimize adverse interactions between bears and the public.

Continue to develop subsistence brown bear hunting regulations and harvest assessment techniques that are supported by both the local village councils and the U.S. Fish and Wildlife Service.

Develop a cooperative management plan for the Unit 18 brown/grizzly bear population within the Western Alaska Brown Bear Management Area in cooperation with the U.S. Fish and Wildlife Service (USFWS) and local village councils within the Western Alaska Brown Bear Management Area (WABBMA) 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 by alerting the public about the presence of bears to prevent access by bears to human food or garbage. Reducing these garbage and food/bear interactions will reduce bear/human confrontations which risk human injury or death or often result in 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 will be done through the Western Alaska Brown Bear Management Area regulations and developing 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 Association of Village Council Presidents, 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 staff and ADF&G management staff about the possibility of a cooperative brown bear research project within the Yukon Delta and Togiak National Wildlife Refuge, and portions of Units 17 B and 18 to estimate brown bear densities. The potential for a density estimate and learning results of bear research in Unit 18 was also discussed at village meetings and at advisory committee meetings.

A cooperative project with the FWS, the department, and Bureau of Land Management (BLM) to study brown bear density, movements, and population parameters in southwestern Alaska was begun in 1993. Methods used in this effort are found in a capture-recapture technique for bears developed by Miller et al (1987).

During June 1993, the first year of the project, 63 brown bears were sighted, 39 bears were captured, and 26 bears were radiocollared in a 3,760 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, June 1, 1993 through May 31, 1994, we found that 4 male bears had shed their collars, and 1 female was harvested during the hunting season. All collars were retrieved. During May 11 and 12, 1994 the department, FWS,

and local village councils from Unit 18 and Unit 17 held meetings to address widespread opposition to the handling of brown bears during the capture effort.

As a result of these negotiations, our capture effort was greatly reduced during 1994. 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 radiocollared is 29 females (Table 2). 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 eartagged and/or tattooed with an identification number. 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.

Postcards were sent out, along with 1 reminder letter to all subsistence brown bear hunters who registered to hunt in the WABBMA during the 1992-93 and the 1993-94 regulatory years. This was the first attempt by the department to gather unitwide subsistence brown bear harvest information. 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 record 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 investigate circumstances surrounding DLP and illegal kills.

Village leaders, hunters, and law enforcement personnel were contacted in an effort to minimize bear-human conflicts at camps and dumps. 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 trend of the bear population is moderate and stable, recovering from the high harvest levels of 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 been able to handle 62 brown bears and observe 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 June 4, 1994 limited, trial search effort results, we estimate 18% of the brown bear population within the study area surveyed is radio-collared. For an accurate, statistically valid estimate, approximately 50% of the population should

be marked. It is hoped that additional collaring and a density estimate will be completed during FY 96 or later.

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 previous S&I reports and available habitat.

Population Composition: Based upon the sample of 56 bears >20 months of age, the composition of bears 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 is approximately 8 to 9 years old ($n = 59$). The capture population age structure of this study shows a lack of some older age classes or adult cohorts (Table 2). Missing cohorts may be characteristic of brown bear populations since during 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 deltaic habitats.

Mortality

Harvest:

Season and Bag Limit:

Unit 18

One bear every four regulatory years	Resident Season 10 Sept - 10 Oct 10 Apr - 25 May	Nonresident Season 10 Sept - 10 Oct 10 May - 25 May
One bear every regulatory year	Subsistence Open Season 1 Sep - 31 May	

Game Board 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 subunits 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 (September 1-May 31), 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 $25 tag and resembles a harvest ticket, at no cost to the hunter. Brown bear skulls and hides no longer had to be sealed by subsistence brown bear hunters, unless the hide or skull was exported outside the Western Alaska Brown Bear Management Area. 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, $25 tag fee, and sealing of the skull and hide were required.

Hunter Harvest. During the 1992-93 regulatory year, the reported harvest was 12 bears (7 subsistence and 5 sport) and during 1993-94, the reported harvest was 7 bears (4 subsistence and 3 sport). The sex ratio of the harvest for the 1992-93 regulatory year was 8 males to 4 females; during the 1993-94 regulatory year the ratio was 6 males to 1 female. (See Table 1 and Figure 1 for historical reported harvest in Unit 18.)

Reported harvest from Unit 18 from 1970 to 1978 averaged 2.0 bears/year, while 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 1986-87, 4 bears in 1987-88, 1 bear in 1988-89 and 6 bears were reportedly taken during the 1989-90 regulatory year. Three bears were reportedly harvested during the 1990-91 season and 4 were reported harvested the 1991-92 season. Annual reported harvest in Unit 18 has never exceeded 30 bears in one year, which may indicate bear abundance is less than that of bears found in other portions of the state. (Figure 1)

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 10-20 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, any conclusions based solely on reported harvest must be viewed with caution.

Hunter Residency and Success. During the 1992-93 regulatory year, 2 residents and 3 nonresidents bagged brown bears under the general hunting regulations. During 1993-94, 3

nonresident hunters bagged bears. The subsistence harvest during 1992-93 and 1993-94 was 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 had never entered the field. Also, the 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 bagged 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 saw no 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 the spring of 1994. Interestingly, the overall 1993-94 subsistence harvest of 4 bears took place during the fall season.

Transport Methods. The guided nonresident hunters used aircraft for transportation. One non-local resident hunter used a boat for transportation, the other used aircraft during the 1992-93 fall season. In spring 1993, 4 hunters used snowmachines to harvest bears and 2 used aircraft. During the 1993-94 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.

Natural Mortality. We have no specific information on natural mortality of brown bears in Unit 18. The high incidence of observed adult bears and low incidence of sows with cubs-of-the-year during our 1993 capture effort may be the result of cubs being preyed upon by adult male bears.

Habitat

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 and land status is not expected to change.

CONCLUSIONS AND RECOMMENDATIONS

Lack of objective data on the brown bear population and little information on nonhunting mortality make effective management difficult. 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. It is becoming increasingly more important to collect accurate bear population information with increasing local 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 inaccurate or incomplete to a significant degree, harvest statistics can become impossible to interpret. A large percentage of misreporting probably negates the value of the harvest data in Unit 18, and lower levels of misreporting severely compromises our ability to detect trends in bear populations within particular drainages. We should continue efforts in developing reliable, accurate, and repeatable techniques for gathering subsistence brown bear harvest information.

LITERATURE CITED

Miller, S.D., E.F. Becker, and W.B. Ballard. 1987. Black and brown bear density estimates using modified capture-recapture techniques in Alaska. Int. Conf. Bear Res. and Manage. 7:23-25.

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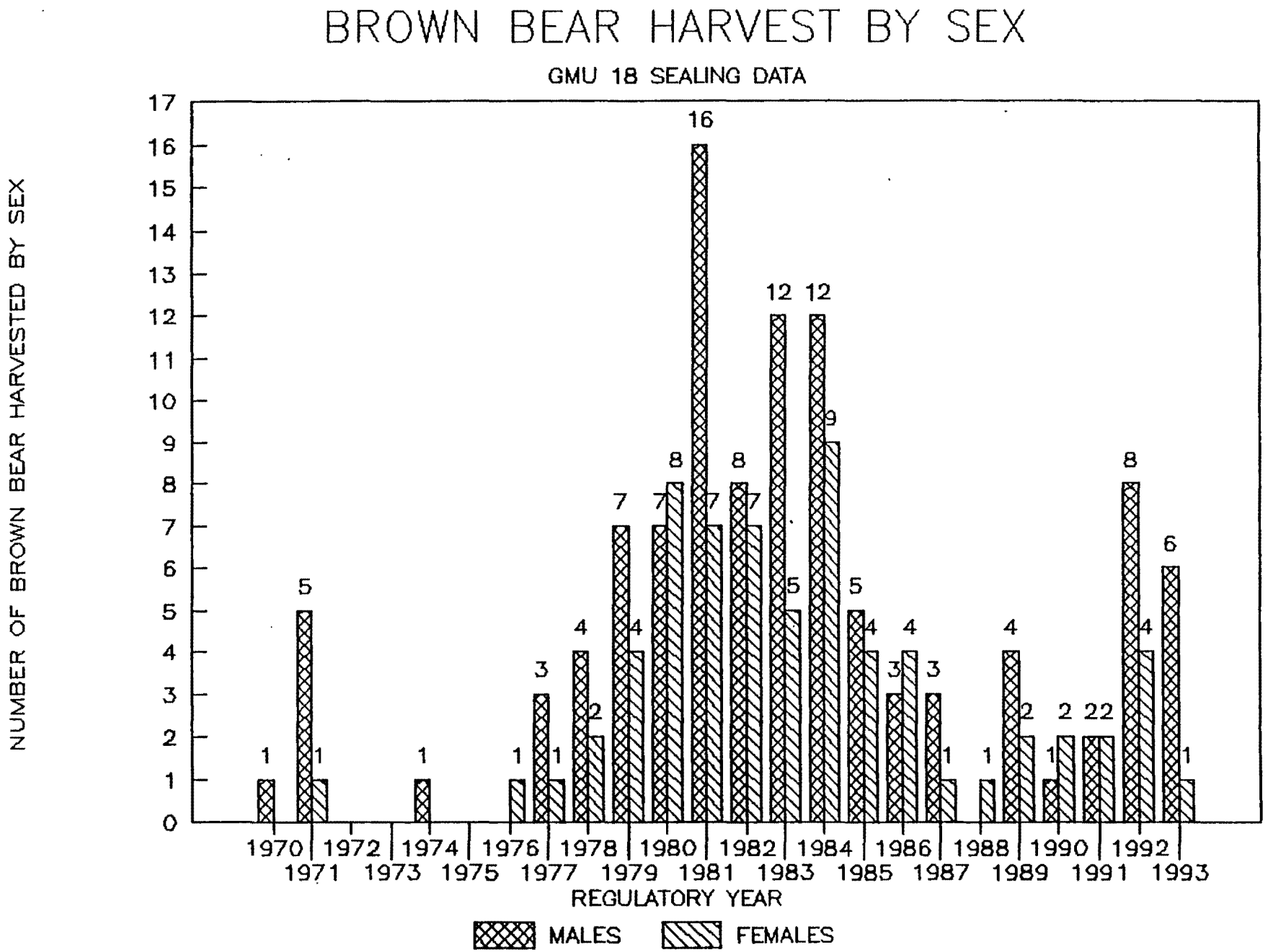

Figure 1 Unit 18 brown bear harvest by sex, 1970-93

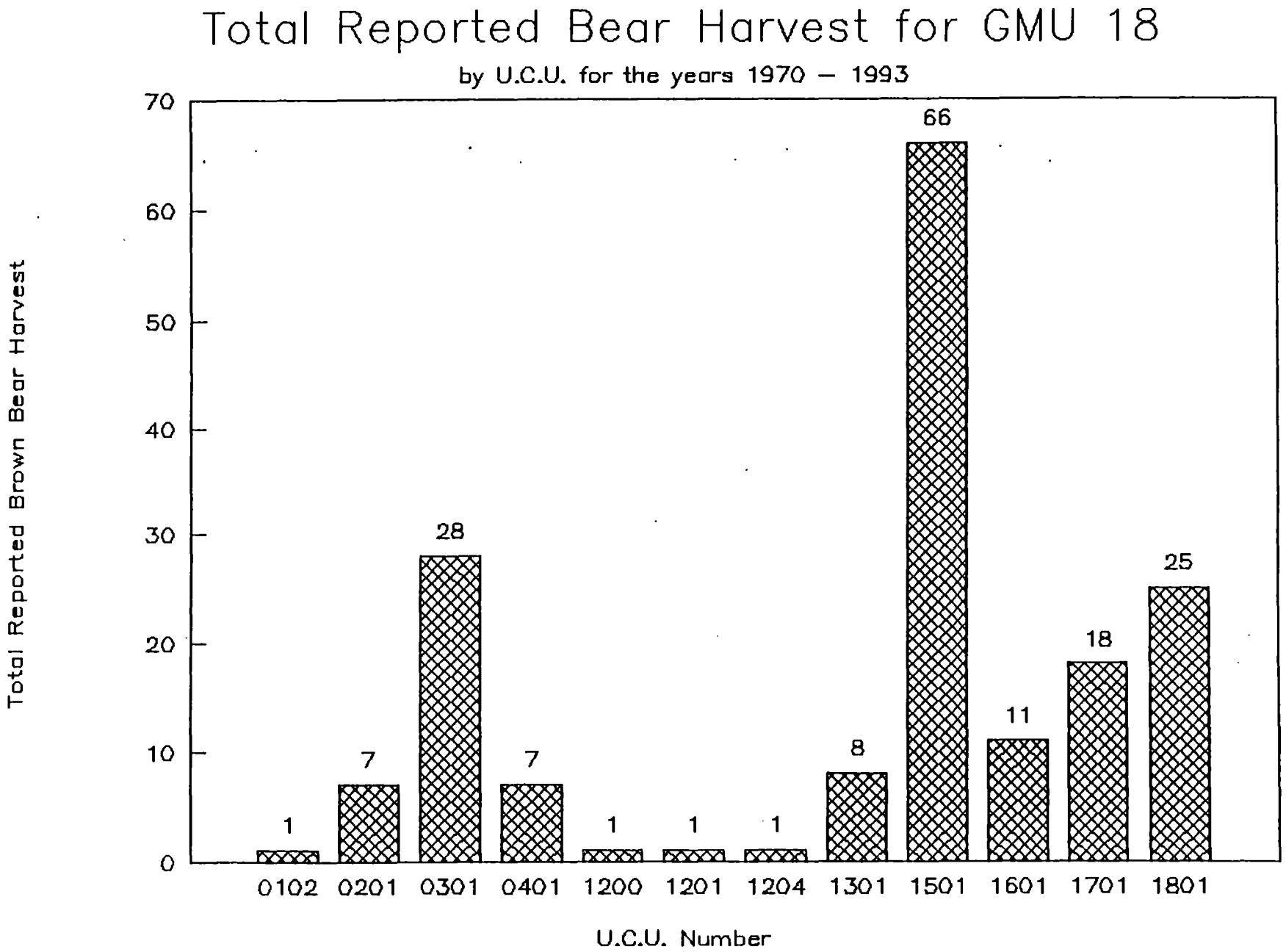

Figure 2 Unit 18 brown bear reported harvest by uniform coding unit, 1970-93

Unit 18

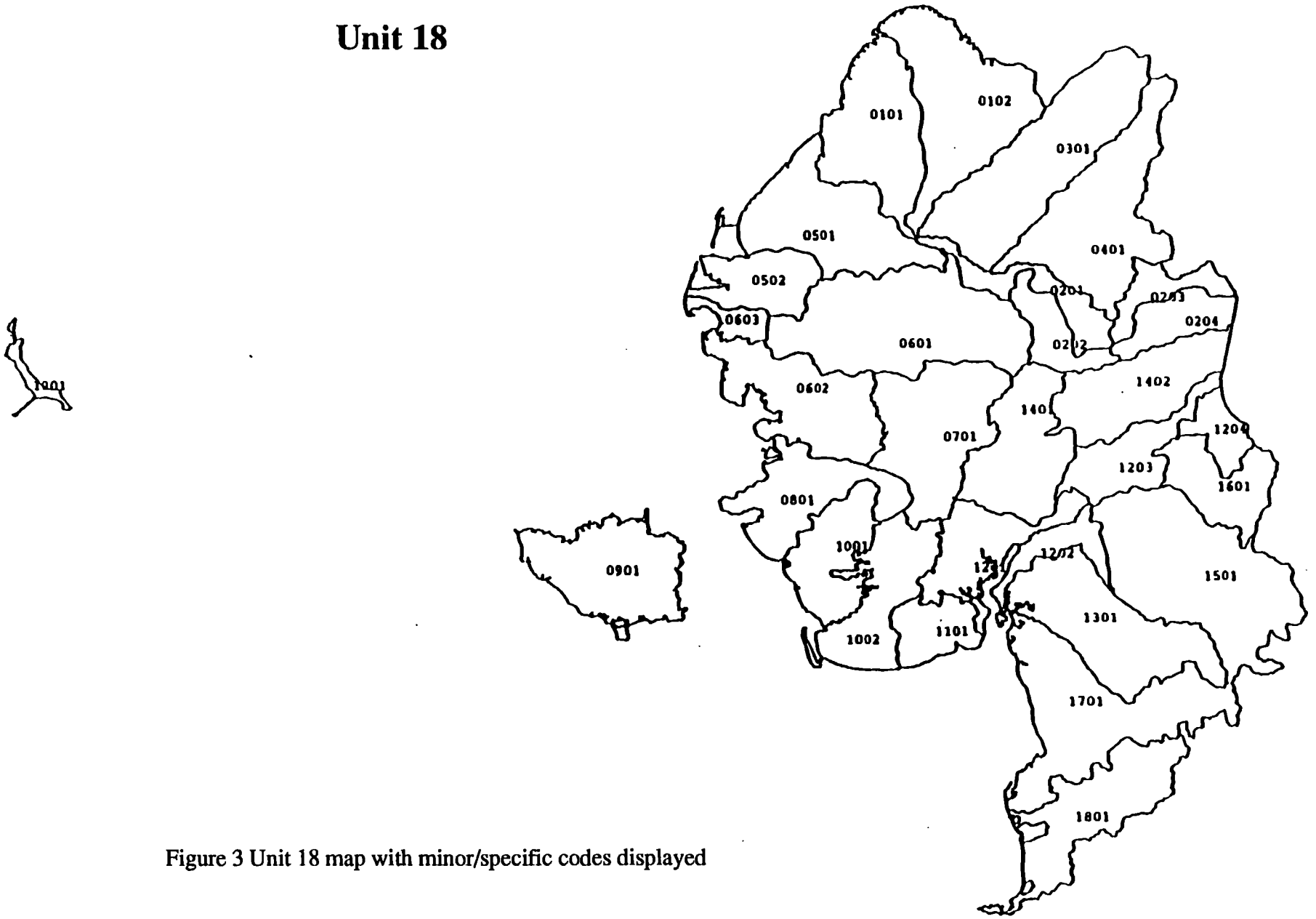

Figure 3 Unit 18 map with minor/specific codes displayed

Unit 18 Brown Bear Study Area

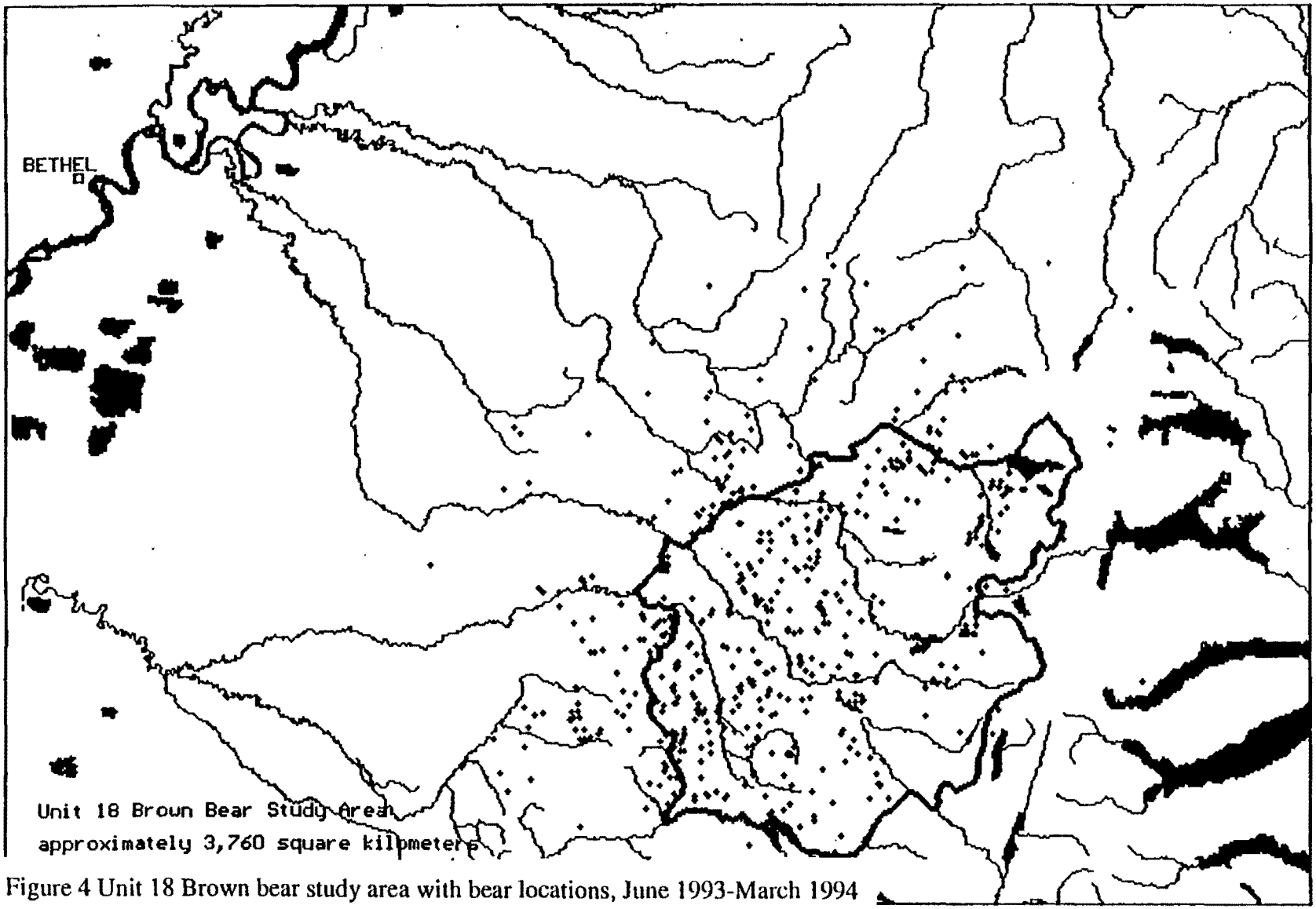

Figure 4 Unit 18 Brown bear study area with bear locations, June 1993-March 1994

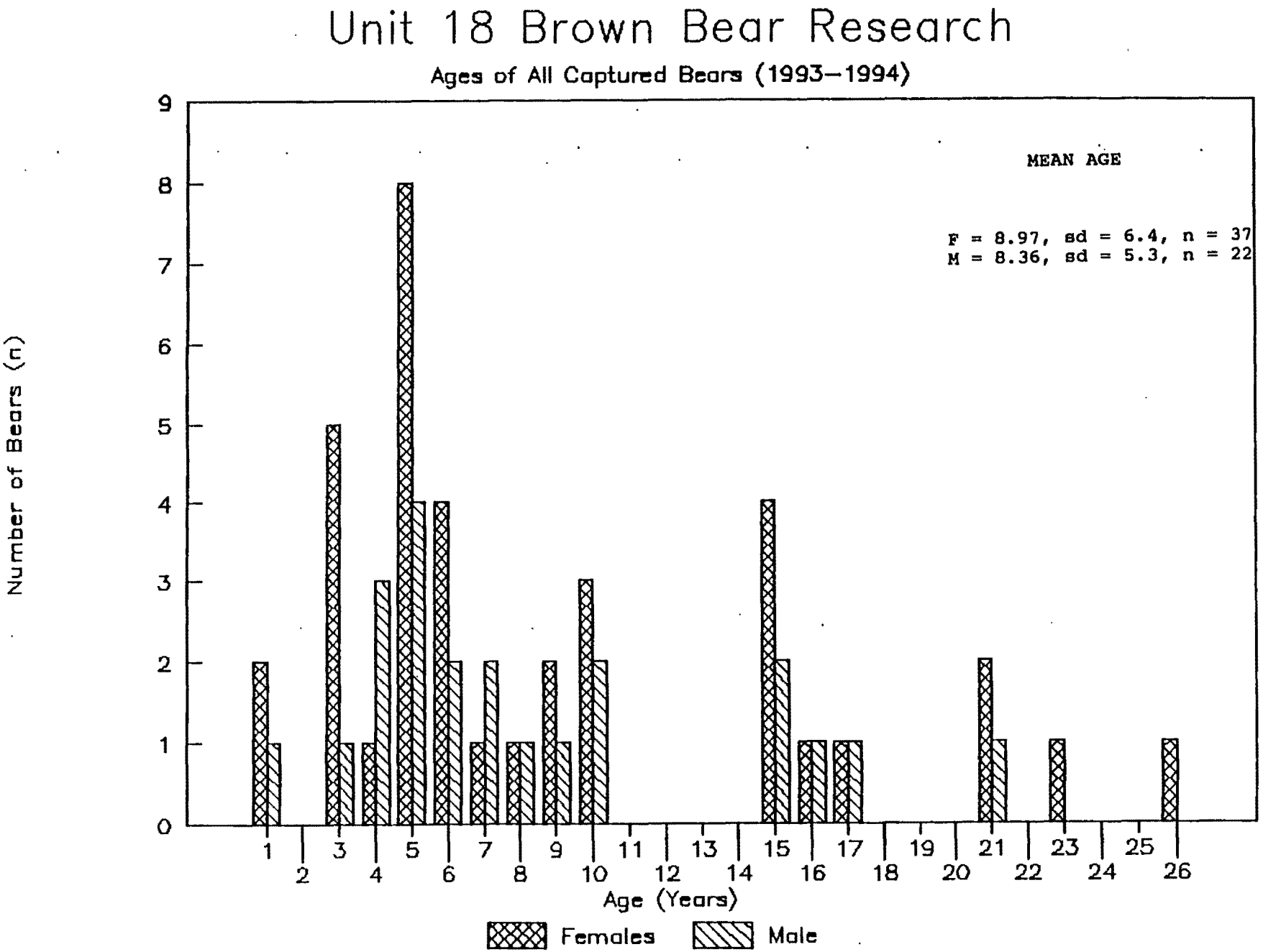

Figure 5 Unit 18 Ages of all captured brown bears, 1993-94

Table 1. Unit 18 brown bear harvest, 1989-1994.

Regulatory year	Reported harvest: Hunter kill M	F	(%)	Unk.	Total	Other kills M	F	Unk.	Estimated illegal kill[a]	Total estimated kill M	(%)	F	(%)	Unk.	Total
1989															
Fall 1989	2	1			3										
Spring 1990	2	1			3	2			5						
Total	4	2			6	2				6	(75)	2	(25)	5	13
1990															
Fall 1990	0	1			1										
Spring 1991	2	0			2	0			10						
Total	2	1			3					2	(67)	1	(33)	10	13
1991															
Fall 1991	2	2			4										
Spring 1992	0	0			0	0			5						
Total	2	2			4					2	(50)	2	(50)	5	9
1992															
Fall 1992	4	2			6										
Spring 1993	4	2			6	1			2						
Total	8	4			12	1				9	(69)	4	(31)	2	15
1993															
Fall 1993	4	0			4										
Spring 1994	2	1		3	1				0						
Total	6	1			7	1				6	(75)	2	(25)		8

[a] Unreported estimated illegal kill.

Table 2. Summary of brown bears captured 1-7 June 1993 and 1-3 June 1994 in the southwestern Kuskokwim Mountains in Unit 18.

Bear ID Number	Radiocollared	Sex	Age	Capture Date
100	Yes	F	14	1 June 1993
101[1]	Yes	M	5	1 June 1993
102	Yes	F	4	1 June 1993
103	Yes	F	5	1 June 1993
104[2]	Yes	M	8	1 June 1993
105	Yes	F	4	1 June 1993
106	No	M	5	1 June 1993
107[3]	Yes	F	15	1 June 1993
108	No	F	2	1 June 1993
109[2]	Yes	M	6	2 June 1993
110[4]	No	M	14	2 June 1993
111	Yes	F	8	2 June 1993
112[2]	Yes	M	14	2 June 1993
113	Yes	F	14	2 June 1993
114	No	M	7	2 June 1993
115	Yes	F	5	2 June 1993
116	Yes	F	6	3 June 1993
117	No	M	3	3 June 1993
118	No	F	2	3 June 1993
119	No	F	2	3 June 1993
120	Yes	F	3	3 June 1993
121	Yes	F	5	3 June 1993
122	No	M	21	3 June 1993
123	Yes	F	4	4 June 1993
124	No	M	16	4 June 1993
125	Yes	F	5	4 June 1993
126	No	M	4	4 June 1993
127	Yes	F	4	5 June 1993
128	Yes	F	4	5 June 1993
129	Yes	F	25	5 June 1993
130	No	F	2	5 June 1993
131	Yes	F	14	5 June 1993
132	Yes	F	9	5 June 1993
133	Yes	F	7	6 June 1993
134	Yes	F	9	6 June 1993
135	Yes	F	22	6 June 1993
136	Yes	F	4	6 June 1993
137	No	M	4	7 June 1993
138	No	M	4	7 June 1993
139	No	M	10	1 June 1994
140	No	M	4	1 June 1994
141	No	F	3	1 June 1994
142	No	M	4	1 June 1994
143	Yes	F	10	1 June 1994
144	No	M	5	1 June 1994

Table 2 Continued

Bear ID Number	Radiocollared	Sex	Age	Capture Date
145	Yes	F	5	2 June 1994
146	No	M	16	2 June 1994
147	Yes	F	15[5]	2 June 1994
148	No	M	7	2 June 1994
149	Yes	F	21	2 June 1994
150	No	M	10	2 June 1994
151	Yes	F	21	2 June 1994
152	Yes	F	9	2 June 1994
153	No	F	1	2 June 1994
154	Yes	F	5	2 June 1994
155	Yes	F	16	3 June 1994
156	No	F	1[5]	3 June 1994
157	No	M	1[5]	3 June 1994
158	No	M	3	3 June 1994

[1] Dropped collar in August 1993.
[2] Dropped collar in June 1993.
[3] Dropped collar in July 1993.
[4] Harvested by sport hunter in September 1993.
[5] Estimated age.

LOCATION

Game Management Unit: 19 (37,000 mi^2)

Geographical Description: All drainages of the Kuskokwim River upstream of the village of Kalskag

BACKGROUND

Although brown/grizzly bears are distributed throughout Unit 19, interest in sport harvest and densities vary in specific portions of the unit. 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 and densities are only speculative. Harvests have generally fluctuated with season lengths and 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, seasons were shortened severely, and by the early 1980s harvests declined. Throughout the 1980s harvests remained relatively low but slowly increased until the early 1990s.

Based on incidental observations and discussions with area hunters and guides, brown bear numbers are slowly increasing. I suspect the recent season liberalization has facilitated the increasing trend in numbers of brown bears harvested.

MANAGEMENT DIRECTION

Management Goals

There are 3 existing 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. Finally, south the Kuskokwim River upstream from Aniak, the primary goal is to provide the opportunity to take large brown bears; the secondary goal in this western part of the unit is to provide the opportunity to hunt brown bears under aesthetically pleasing conditions. The western portion of the unit, from the Aniak River drainage and downstream, is included in the Western Alaska Brown Bear Management Area, in which subsistence uses of bears have been identified as a priority.

Management Objectives

- Maintain a brown bear population capable of sustaining a mean annual harvest of at least 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 density estimation surveys have been conducted in Unit 19. Harvest trend, based on sealing documents, is reviewed annually and regulations amended when harvest data indicate the need.

RESULTS AND DISCUSSION

Population Size and Composition

A rough population estimate of 900 brown bears was calculated by Pegau (1987). No bear surveys have been conducted since then; 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 1 bear per 25 mi^2, or a total of about 300 bears. Unit 19C has an estimated 5200 mi^2 of good habitat (1 bear/25 mi^2 = 210 bears) and about 1500 mi^2 of poor habitat (1 bear/50 mi^2 = 30 bears). Unit 19D generally contains poor habitat (1 bear/75 mi^2 = 165 bears). Unit 19A has habitat which probably contains about 1 bear per 50 mi^2, for 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, I estimate an overall density of 1 bear per 41 mi^2.

Because no formal survey work has been conducted, the trend of the Unit 19 brown bear population is unclear. From analyses of harvest data, it appears that present human use of the brown bear population is moderate. Assuming the above calculations are reasonably accurate, I believe the 5-year mean annual harvest (1989-90 through 1993-94) of 41.4 brown bears is less than 5% of the total population.

Mortality

Harvest: Following relatively low harvests throughout the 1960s (1961-70, 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 with the 2 earlier decades (1981-90 mean annual harvest = 28 bears; Fig 1). 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 1994-95 regulatory year.

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

Board of Game Actions. 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 to 56 days, the board made minor changes to fall opening and spring closing dates and elected to leave the winter period open. Initially, it appeared that season length increased almost 5-fold; however, because of winter denning, effective brown bear hunting opportunities will change little. I suspect that increased season lengths will result in only slightly higher harvest, most of which will be additional males taken in May.

Sex Ratio in the Harvest. Because present harvest levels are thought to be at low enough levels 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% (Fig 2). The percentage of males in the reported harvest has 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 multispecies hunts, and hunters are not necessarily attempting to take a record-class animal. Therefore, harvest of females (except those with cubs or yearlings) is not avoided. Until brown bear hunting effort becomes more intensive in Unit 19, a management scheme designed to harvest greater than 50% males should afford protection needed to sustain the population.

Hunter Residency and Success. During the past 33 years while sealing has been mandatory, 906 of 1161 bears (78%) were harvested by nonresidents of the state, and in only 1 year has reported nonresident harvest been less than 50% of the total 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 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 1993, 38 of 173 (22%) harvested bears were taken during spring, providing the desired effect of increasing spring harvests with less restrictive spring seasons.

Method of Transportation. Of successful hunters who listed method of transportation on their sealing documents between 1961 and 1993, 855 of 963 (89%) used airplanes as their primary access method (Table 5). This percentage has not changed significantly since sealing began.

CONCLUSIONS AND RECOMMENDATIONS

Additional harvest restrictions appear unnecessary because current seasons and bag limits allow 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). However, following the longer seasons authorized by the Board of Game in 1990, close scrutiny of harvest data must occur annually, and changes enacted if warranted. Brown bear predation on moose, caribou, and/or bison is not currently an apparent widespread problem in the unit.

Annual review of sealing certificate data will continue. If sex ratios in the harvest begin to favor females, changes in season lengths should be considered. Mean ages of harvested bears have fluctuated annually, but the older-age cohorts of the population remain intact.

Personal contacts in villages and fish camps by ADF&G and FWP personnel will continue to stress the need to document harvests, whether they are legal harvests or are taken under DLP provisions. Because of the present regulation requiring a $25 resident brown bear tag (except for resident hunting within the Western Alaska Brown Bear Management Area), I think 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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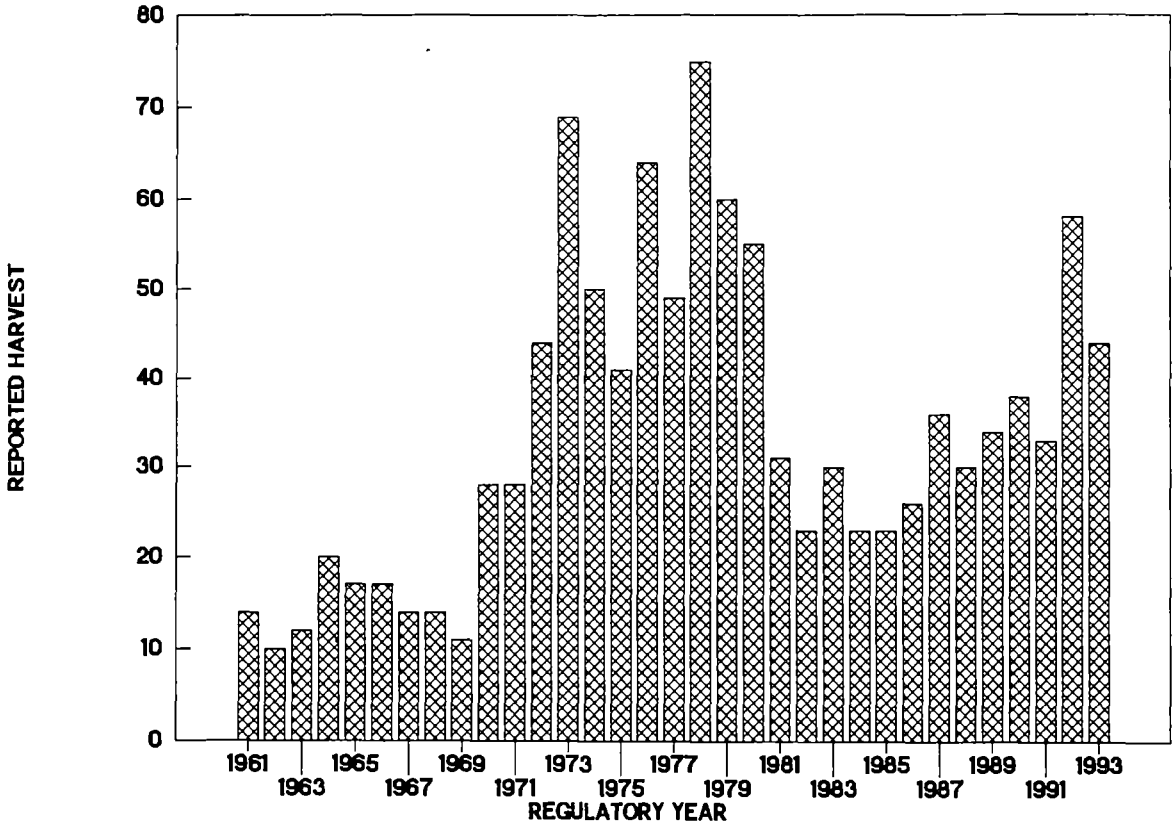

Figure 1 Annual hunter harvest of brown bears in Unit 19, 1961-1993

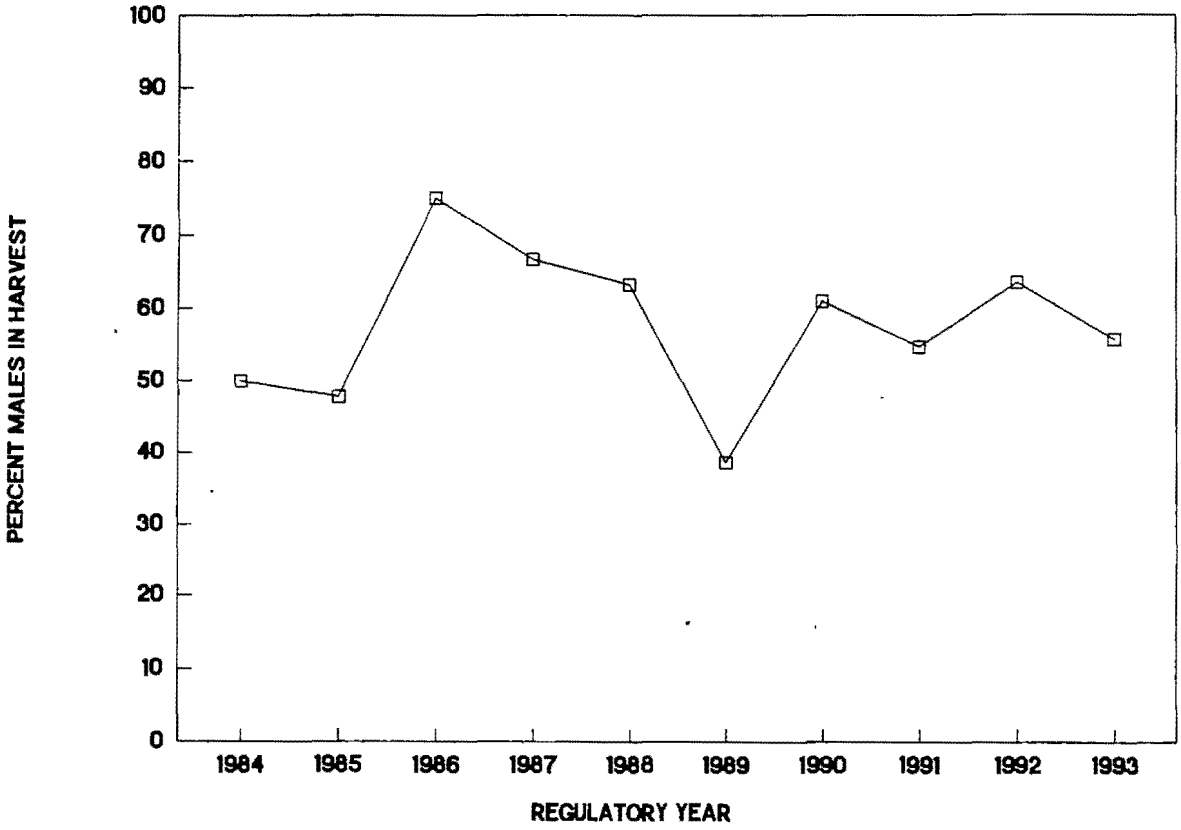

Figure 2 Unit 19 harvest of brown bear males, 1984-1993

Table 1 Annual harvest of brown bears in Unit 19, Alaska, 1984-1993

Regulatory year	Unit 19				Total
	A	B	C	D	
1984	4	7	11	1	23
1985	4	12	4	3	23
1986	4	12	9	1	26
1987	5	18	12	2	37
1988	3	10	16	1	30
1989	0	15	16	3	34
1990	2	15	14	7	38
1991	4	18	9	2	33
1992	11	28	15	4	58
1993	4	25	14	1	44
Total	41	160	120	25	346
Mean	4.1	16.0	12.0	2.5	34.6

Table 2 Unit 19 brown bear harvest, 1984-1993

Regulatory year	Hunter Kill				Non-hunting kill				Total estimate		Grand
	M	F	Unk	Total	M	F	Unk	Total	M (%)	F (%)	Total
1989											
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											
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											
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											
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											
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

Table 3 Unit 19 brown bear successful hunter residency, 1989-1993

Regulatory year	Resident	(%)	Nonresident	(%)	Total successful hunters
1989	5	(15)	29	(85)	34
1990	5	(13)	33	(87)	38
1991	8	(24)	25	(76)	33
1992	17	(29)	41	(71)	58
1993	8	(18)	36	(82)	44

Table 4 Unit 19 brown bear harvest chronology percent age by month, 1989-1993

Regulatory year	Percent by month of harvest						
	Sep	Oct	Nov	Apr	May	Other	*n*
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

Table 5 Unit 19 brown bear harvest percentage by transport method, 1989-1993

Regulatory year	Percent of harvest									
	Airplane	Horse	Boat	3 or 4-wheeler	Snowmachine	ORV	Highway Vehicle	Walk	Unknown	*n*
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

LOCATION

Game Management Unit: 20A, 20B, 20C, 20F, and 25C (39,228 mi^2)

Geographical Description: Central and Lower Tanana Valley, and Middle Yukon River drainages

BACKGROUND

Grizzly bears are found throughout this area, with highest densities in the Alaska Range portions of Units 20A and 20C. In a portion of the Unit 20A mountains, a long-term grizzly bear research project began in 1981 to 1) gather baseline data on population status and reproductive biology (1981-1985; Reynolds and Hechtel 1986) and 2) study effects of high exploitation rates on grizzly bear population dynamics (1986-1991; Reynolds and Boudreau 1992, Reynolds 1993). During the latter phase of the project, grizzly bears in the study area were deliberately subjected to high harvest ($\geq$ 11% of the population versus $\leq$ 6% before 1981. As a result, Reynolds (1993) documented a 20% decline in the bears ($\geq$ 2 years old) in this area since 1981. The grizzly bear density within the Unit 20C mountains is higher than that of Unit 20A mountains, but is largely protected from hunting because it is within the original boundaries of Denali National Park. The eastern half of Unit 20B supports a moderate density of grizzly bears and has been the second area (in addition to Unit 20A mountains) where harvest has been concentrated within this study area. Grizzly bear populations in the remainder of the study area are approximately half the density (or less) as in the Unit 20A mountains and are harvested less intensively.

Grizzly bears are significant predators of moose in Unit 13 (Ballard et al. 1981) and Unit 20E (Gasaway et al. 1992) but not on the Tanana Flats portion of Unit 20A (Gasaway et al. 1983). Grizzly bears also affect moose and caribou populations in this study area, but predation rates by grizzly bears have not been investigated here.

In response to an increasing human population and interest in hunting grizzly bears, McNay (1991) analyzed harvest and population data from this study area to develop specific management objectives and harvest quotas. These quotas were based on a sustainable harvest rate of 8% of the total population (Miller 1990). To interpret harvest data from subunits where annual harvests are relatively small and variable, we used 3-year mean harvest quotas.

The number of productive females within a population is the most important factor in the rate of growth or decline in grizzly bear populations (Craighead et al. 1976, Knight and Eberhardt 1984). The number of adult females in the research study area of Unit 20A was relatively stable (21 to 23) from 1981-1989 when harvest rates were 6.3%. However, the projected adult female population in spring 1993 was only 14, after harvest rates of 16.7% from 1989-1992. Unless the number of productive females recovers, the population will probably continue to decline (Reynolds 1993). Because of fidelity to maternal home ranges, females will probably not migrate into this area.

To allow the population to recover, Reynolds (1993) now recommends that beginning in fall 1992 mean harvest rates be reduced to 3% of the adult females and no more than 6% to 8% of bears ≥ 2 years old until at least 1995.

This report covers regulatory years 1992 and 1993 or calendar years 1991, 1992, and 1993. We have analyzed grizzly bear harvest data based on both regulatory and calendar years. Listing information only by regulatory year results in problems because of combining 2 age cohorts in 1 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 largely unaffected by human activity and not subjected to hunting.

Management Objectives

Unit 20A Mountains:

- Decrease human-caused grizzly bear mortality until at least 1995 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 new research project (W-24-1, Study 4.25) 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 and

- To 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 combined:

- 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 quotas: 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 location, date of kill, sex, skull size, defense of life or property, hunter residency, transportation method, kill type (hunter harvest, illegal kill, research mortality, etc.), and commercial services used. We coded sealing certificates from bears killed in this study area according to Uniform Coding Units (UCUs). During sealing, we collected premolars for determining age. Most of the grizzly bears harvested in this study area were sealed in the department's regional office in Fairbanks; there are no authorized private-sector bear sealers in the Fairbanks area. We used a printout of sealing data provided by the Statistics Section (21 Nov 1994) for our database.

In previous reports grizzly bear harvest was reported based on regulatory years. In this report most of the harvest data I have presented is based on calendar year to avoid lumping different cohorts into the same year.

Population Size and Density

In June 1993 H Reynolds and I stratified Units 20A, 20B, 20C, 20F, and 25C into 4 grizzly bear density strata: low, medium, high, and super. Low density areas were those containing significant human development, areas of poorly drained soils, or permafrost areas predominated by black spruce. Medium density areas included upland forest and tundra habitats at elevations generally

between 500 and 1500 feet. High density areas were those most similar in elevation and habitat to areas of known density in Units 20A, 20E, and 13E. Super density areas included habitat similar to the high density areas, but where no harvest is permitted. We assigned UCUs into a stratum based on topography, habitat, and accessibility to humans.

We calculated the total area within each stratum using the mi^2 listed for each UCU (Uniform Coding Units-Square Mile Listing, Version 2.0, 28 July 1990). Square miles were converted to km^2 using a correction factor of 2.59. We excluded approximately 1300 km^2 area of glaciers and land above 6000 feet from the Unit 20A high density stratum and 1000 km^2 of similar topography in the Unit 20C super stratum.

We estimated grizzly bear (all ages) densities in each of 4 stratum on the following basis: 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. I then multiplied the area for each stratum by the range of bear densities for that stratum to calculate a population estimate. We estimated the status of the population in each subunit as stable, increasing, or decreasing.

We recalculated the size of the Unit 20A mountains zone using sizes for UCUs listed in the UCU printout. We consider this zone to include 7980 km^2 of bear habitat (9275 km^2 minus about 1295 km^2 block of glaciers and land above 6000 ft). The Unit 20A mountains zone has previously been reported to include 9315 km^2.

Population Composition

The only sex and age composition data available for the grizzly bear population in this area is from research in a portion of the Unit 20A mountains (3160 km^2) (Reynolds, pers commun). I calculated the number of bears in each sex and age category for the entire Unit 20A mountains (7980 km^2 of bear habitat) by multiplying the estimated population size by the percentage of the population within each sex and age class (adjusted for closure), as indicated by the research project.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size:

Stratification. We classified 62% of the 99,116 km^2 of potential grizzly bear habitat within this study area as low density (1-3 grizzly bears/1000 km^2), 21% as medium density (5-10 bears/1000 km^2), 8% as high density (14-17 bears/1000 km^2), and 8% as super (20-30 bears/1000 km^2) (Table 1). Our rationale for this stratification is as follows.

Unit 20A. We considered the foothills of Unit 20A high density with a range of 14-17 bears/1000 km^2. We estimated this range based on research in the central foothills where densities ranged

from 16.7 total bears/1000 km^2 for a 3160 km^2 area in 1992 (Reynolds 1993) to 14.6/1000 in a subset of that area in 1993 (Reynolds, pers commun). Although we recognize that densities in the foothills outside this study area may be different, we believe the range of 14-17/1000 km^2 was representative of the entire foothills.

The Unit 20A Tanana Flats are relatively poor grizzly bear habitat, and we classified it as low density. Many grizzly bears on the Tanana Flats are probably dispersers from the foothills, bears traveling through en route to other areas, or bears making forays into the flats from the foothills. We estimated the flats provide habitat for 20 grizzly bears, or 2.5 bears/1000 km^2. Our range of 1-3 bears/1000 km^2 was an adjustment downward slightly from the 2.5 so that the low stratum was more representative of even lower densities found in other subunits.

Unit 20C. We classified the Alaska Range portion of Unit 20C as super, with 20-30 grizzly bears/1000 km^2. Although Dean (1987) estimated 34 bears/1000 km^2 for a portion of this area in 1983, Dean's surveys were in the core area along the Denali Park Road where densities were probably highest within the stratum. We assumed densities would be similar to, or higher than, the 23 bears/1000 km^2 that Reynolds documented in Unit 20A in 1981. Densities are higher in the Alaska Range portion of Unit 20C than in Unit 20A because most of the former is within the old Denali National Park, which is closed to hunting. Most of the portion outside the old park is within the new park, relatively inaccessible and open to federal subsistence hunters only.

We classified a small portion of northwestern Unit 20C as medium density. The range of 5-10 bears/1000 km^2 is reasonable because habitat quality is less than that in the Unit 20A foothills and higher than that in the flats. This area is adjacent to some fair grizzly bear habitat in the upper Kuskokwim drainage, open to hunting, but relatively inaccessible.

We considered the remainder of Unit 20C to be low density, although it may have slightly higher densities than the low density stratum in the Unit 20A flats. The Unit 20C flats have salmon streams, bears that disperse from the super-high stratum, and relatively low hunting pressure.

Unit 20B. We 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 included in the low density stratum because of good access and proximity to human activity. We considered the upper Chena and Salcha rivers as medium density because of the better habitat and relative inaccessibility.

Unit 20F. The Tozitna River drainage/Ray Mountains portion of Unit 20F has relatively good grizzly bear habitat, and we classified it as medium density. It is relatively inaccessible and we do not have much information from that area.

We classified the remainder of Unit 20F as low density. Even though there is some good habitat in the Sawtooth Mountains, that area supports moderate human activity. Much of the rest of the area includes lowlands and relatively poor grizzly bear habitat.

Unit 25C. We considered the mountainous portion of Unit 25C as medium density. This is an extension of the medium density area of eastern Unit 20B and also includes the White Mountains. Although habitat is good, a road and numerous trails exist through the area. Hunters take grizzly bears incidental to their pursuit of caribou and moose.

Population Estimate. Extrapolating from this stratification, we estimated that 446-782 grizzly bears (all ages) inhabit this study area (Table 1). Using the midpoint of the population estimate (614 bears), the combined subunit density is probably about 6.2 grizzly bears/1000 km^2. Units 20C and 20A had the highest densities (8.8 and 8.5/1000, respectively) and Unit 20B the lowest (3.4/1000). Estimates for number of grizzly bears (all ages) in each subunit included: 120-160 in Unit 20A, 47-112 in Unit 20B, 195-326 in Unit 20C, 36-83 in Unit 20F, and 48-101 in Unit 25C.

Because of our objective to manage the Unit 20A mountains harvest based on the number of bears ≥ 2 years old, we also estimated 111 grizzly bears ≥ 2 years old inhabit that area (13.9 bears ≥ 2 years old/1000 km^2, [Reynolds, pers commun], for 7980 km^2 of bear habitat). This compares with approximately 134 bears of all ages in the same area.

Population Composition: By extrapolating from composition data obtained in the research study area in a portion of Unit 20A mountains (Table 2), I estimate during spring 1992 the population of 134 bears (all ages) in the entire Unit 20A mountains included 46 bears ≥ 6 years old (34 females, 12 males), 65 bears 2-5 years old (40 females, 25 males), and 23 bears ≤ 1 year old (no sex data) (Table 3).

Reynolds (1993) summarized the average productivity of the population between 1982 and 1992 in his study area as follows. Female grizzly bears produced their first litters at 6.2 years and their first surviving litters at 7.1 years. They had 2.1 cubs of the year ($n = 43$) and 2.0 offspring weaned as 2- or 3-year-olds ($n = 20$). Although the difference in mean litter size between cubs and yearlings is small, it is primarily because of the mortality of entire litters rather than high survival rates. Females produced weaned offspring in an average of 4-year intervals.

Distribution and Movements: Based on research from 1981-1992 in a portion of the Unit 20A mountains (Reynolds 1993), the following patterns of fidelity to maternal or established home ranges were found. All females ($n = 44$) remained near their maternal home ranges and none emigrated from the study area. In contrast, all males weaned or captured as 2- or 3-year-olds emigrated from their maternal or established home ranges within 2 years. Males ≥ 4 years old immigrated into the study area, with none later emigrating from the study area.

Mortality

Harvest:

Season and Bag Limit. In regulatory years 1990 through 1993, the resident and nonresident open season for grizzly bears was 1 September-31 May with a bag limit of 1 bear every 4 regulatory years. In 1994 the season was shortened by 9 days to 10 September-31 May with no change in the bag limit.

Board of Game Actions and Emergency Orders. At the spring 1994 Board of Game meeting, the board approved our proposal to shorten the grizzly bear season in Unit 20A. We submitted this proposal because of the high harvest and apparent decline in the number of adult females in the Alaska Range population. The new season (10 Sep-31 May) went into effect in fall 1994.

Hunter Harvest. Harvest in Unit 20A, 20B, 20C, 20F, and 25C has been relatively stable during the last 3 years, with a mean of 33 bears. In 1992-1993 hunters reported taking 44 grizzly bears in the 5 subunits (Table 4a-e). In 1993-1994 harvest decreased to 26 grizzly bears.

In addition to harvest by hunters, 5 grizzly bears were killed in DLP incidents in calendar years 1991 through 1993 (1 female in 20A mountains, 2 males in the eastern half of 20B, and 2 males in 20C). An additional 3 bears were killed illegally.

We summarized spring 1994 grizzly bear hunting opportunities in the Interior for a public leaflet to direct hunting pressure toward and away from specific areas.

Harvest Zones

Unit 20A Mountains. During the last 3 calendar years, humans killed 47 grizzly bears in the Unit 20A mountains, including 25 females, 21 males, and 1 bear of unknown sex (Table 5). Twelve bears were killed in 1991, 21 in 1992, and 14 in 1993.

The 1991-1993 mean harvest of 1 adult female (6 years or older) per year represents 2.9% of the estimated population of 34 adult females. This harvest barely meets our objective of 3% of the adult females. This objective was met if any of the 7 females of unknown age were 6 years or older.

I assumed that all bears of unknown age were at least 2 years old because it is illegal to hunt cubs or yearling grizzly bears. Using this assumption, the 1991-1993 mean human-caused mortality of 15 bears (2 years or older) per year represented approximately 14% of the estimated population of 111 bears. Not only is this mortality more than twice as high as our objective of 6% of the population, but only 45% (21/47) of the bears killed were males.

We met our objective to harvest 10-15% of the grizzly bear population (≥ 2 years old) until 1992. The 3-year mean annual harvest (1989-1990 through 1991-1992) of about 10.7 bears was 10% of the estimated population of 111 bears. High harvest rates have resulted in a decline in the grizzly bear population; by 1992 the population of bears ≥ 2 years old in the research study area had declined 20% since 1981 (Reynolds 1993).

We expected the bear harvest to decrease in fall 1992 without changing grizzly bear hunting regulations because the caribou hunting season was closed and fewer hunters would be in the field. However, 19 grizzly bears were killed in the Unit 20A mountains in fall 1992, almost twice the 1989-1992 mean of 11.3 bears per year. To decrease harvest, the season was shortened by 9 days starting fall 1994. Preliminary results indicate the high harvest in the 20A mountains tapered off; only 5 bears (2 males, 3 females) were reported harvested in fall 1994.

Eastern half of 20B. From 1991 through 1993, 17 bears 2 years or older were killed by humans, including 2 males in DLP kills and 1 male killed illegally. The mean mortality of 5.7 bears per year met our objective for no more than 6 bears. However, we exceeded the harvest of females; only 53% (n = 17) of the bears were males instead of our objective for at least 55% males. Most females taken were relatively old; 5 of the 8 females harvested were 15-31 years old.

Unit 20A Flats, western half of 20B, 20C, 20F, and 25C combined. Humans killed 29 bears in this area, including 22 males and 7 females. The overall mean harvest of 9.7 bears per year was only 37% of our quota for 26 bears. In addition, the mortality included 76% (n = 29) males, which easily met our objective for at least 55% males.

Mean annual human-caused mortality quotas were met within individual areas also, with a mean harvest of 1.3 bears from the Unit 20A Flats (quota = 3), 2.3 from the western half of 20B (quota = 3), 3.7 from Unit 20C (quota = 7), 1.3 from Unit 20F (quota = 7), and 1 from Unit 25C (quota = 6).

Harvest Density. For each harvest zone, I calculated a harvest density by dividing the 3-year mean annual harvest of grizzly bears (≥ 2 years old) by the area within that zone (Table 5). The resulting harvest rates included 1.9 bears (≥ 2 years old)/1000 km^2 for the Unit 20A mountains, 0.5/1000 for Unit 20B East, and 0.1/1000 for the combined Units 20A Flats, 20B West, 20C, 20F, and 25C. These harvest densities reflect the combination of bear density and hunting effort, an indicator of hunting pressure in the absence of other information on hunting effort.

Hunter Residency and Success. Sixty-eight percent (68/100) of the grizzly bears killed by humans in the study area during the last 3 regulatory years were killed by Alaska residents (Table 6). Twenty-six percent (26/100) were killed by nonresidents, and 6% (6/100) were killed by hunters whose residency was unknown.

Harvest Chronology. Of the 87 grizzly bears killed by hunters during the last 3 regulatory years, almost half (47%) were taken 1-15 September (Table 7). Another 28% of the bears were taken 16-30 September, and 20% taken 1-31 May. Grizzly bear harvests are generally higher in fall than in spring because many bears are taken opportunistically by hunters primarily hunting moose, caribou, or sheep. Only 10% of the harvest was taken in April or October.

Transport Methods. The methods of transportation used by successful grizzly bear hunters have not changed substantially in recent years. The most popular methods included aircraft (34%), highway vehicle (21%), horse (11%), and boat (11%) (Table 8).

Other Mortality: During his research in the Unit 20A mountains from 1981-1992, Reynolds (1993) observed mean natural mortality rates of 23% for cubs-of-the-year (n = 80), 6% for yearlings (n = 67), 5% for 2-year-olds (n = 39), and 2.5% for adult females (n = 45). These rates included only offspring under maternal care. Reynolds could not determine causes of natural mortality for cubs, yearlings, and 2-year-olds that disappeared while accompanying their mother. However, cannibalism by adult males was suspected as the major cause and has been documented in Alaska (Alaska Range, south of Alaska Range, Brooks Range) and Canada (see review by

Reynolds 1993). Four adult females died of nonhuman-related causes; 2 were eaten by adult males, presumably while they were defending offspring, 1 was found dead and eaten before she weaned her young, and 1 was found dead in her collapsed den.

Habitat

Assessment and Enhancement: As human development extends to grizzly bear habitat, human-bear conflicts often increase. For instance, in fall 1992 a problem was identified at a squatter campsite in Hornet Creek (Unit 20A), adjacent to the entrance of Denali National Park and Preserve. Up to 150 seasonal campers had been using the area with no facilities for garbage disposals, human waste, or food storage. The lack of facilities began attracting bears, and during summer 1992 a black bear was shot in the campsite and a nuisance grizzly bear was shot at a nearby lodge. In February 1993 the Office of the Governor's Division of Governmental Coordination conducted a strategy session in the area to seek solutions to problems associated with unauthorized use of state land and related bear-human conflicts along the Parks Highway near Denali National Park and Preserve. Participants included 5 state agencies, the NPS, Denali Borough, several major local employers, the Denali Citizen's Council, and local residents. Through cooperative efforts, the squatter's campsite was closed and efforts to reduce human-bear conflicts seemed successful.

CONCLUSIONS AND RECOMMENDATIONS

We estimate 450-787 grizzly bears (all ages) live within the 101,601 km^2 of this study area. Excluding the 2300 km^2 we considered nonbear habitat, density estimates for each subunit ranged from 3.4 to 8.8 grizzly bears/1000 km^2.

Harvest has been most intensive in Unit 20A mountains and, to a lesser degree, in the eastern half of Unit 20B. Because of widely varying grizzly bear densities and harvest within the 5 subunits for this report, we will continue to examine harvest and population data based on the 3 harvest zones discussed below.

Unit 20A Mountains: Our spring 1992 estimate of the grizzly bear population included 34 adult females (6 years or older) and 111 bears 2 years or older. Therefore, our objectives were to limit the 3-year mean harvest to no more than 1 adult female (3%) and 7 bears 2 years or older (6%). We met the first objective with a mean harvest of 1 adult female per year from 1991 through 1993 if none of the 7 females of unknown age were adults. However, during the same 3 years, humans killed more than twice the number of bears 2 years and older (15 per year) than our objective. In addition, only 45% (21/47) of these bears were males.

I am concerned about the relatively high harvest of subadult females and plan to discuss new objectives with research staff to ensure adequate recruitment of adult females into this area. Fidelity of subadult females to maternal home ranges leaves little hope that immigration will fill in any overharvested areas.

We did several things to reduce harvest, especially of adult females. We shortened the fall grizzly bear hunting season by 9 days in Unit 20A starting fall 1994. We also printed and distributed small decals reminding hunters to "take a closer look" to determine the sex of bears they want to harvest. These characteristics are explained in detail in a video we provided and recommended.

The next grizzly bear population estimate will be made in spring 1996. I recommend amending the current objectives for the Unit 20A mountains to decrease harvest rates until at least 1996.

Eastern half of Unit 20B: We also met 1 of our 2 objectives in the eastern half of Unit 20B. The 3-year mean (1991-1993) human-caused mortality of 5.7 bears met our objective for up to 6 bears. However, only 53% (9/17) of the bears were males, so we did not meet our objective for at least 55% males. We will continue our efforts to encourage hunting primarily males and to teach the public to differentiate male from female bears in the field.

Units 20A Flats, western half of 20B, 20C, 20F, and 25C Combined: Human-caused mortality of grizzly bears in the remaining areas was relatively low and easily met our objectives. The annual harvest of 14, 9, and 6 bears between 1991 and 1993, respectively, resulted in a mean of 9.7 bears per year, only 37% of our quota for 26 bears. In addition, 76% (22/29) of the bears killed were male, which also meets our objective for at least 55% males. Harvest was distributed appropriately and the number of bears killed in each area was within our objectives.

Human-bear conflicts are more frequent with the rising human population and increasing human activity in grizzly bear habitat. Between 1980 and 1990, the human population in the North Star Borough increased 44% (53,983 to 77,720, respectively). To minimize human-bear conflicts during the next report period, we plan to produce and distribute several handouts for the public. Some handouts will help hunters be more selective when hunting bears, illustrating the differences between male and female grizzly bears, older versus younger grizzly bears, and grizzly bears versus black bears. Other handouts will continue to provide information to the public about bear behavior, proper garbage disposal, and food storage to reduce conflicts.

I recommend adding the following objective:

Minimize human-bear conflicts by providing information and assistance to the public and agencies.

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Table 1 Grizzly bear population (all ages) estimates in Units 20A, 20B, 20C, 20F, and 25C based on stratifying by bear density, spring 1993

Unit	Area in density strata (km^2)[a]					Grizzly bear population estimate[b]						Bear density[d]	Population trend
	Super	High	Med	Low	Total[c]	Super	High	Med	Low	Total	Midpoint		
20A	0	9275 -1295[c] 7980	0	8136	16,116	0	112-136	0	8-24	120-160	140	8.5	Declining
20B	0	0	5864	17,742	23,606	0	0	29-59	18-53	47-112	80	3.4	Stable?
20C	9382 -1000[c] 8382	0	1487	19,957	29,826	168-251	0	7-15	20-60	195-326	261	8.8	Stable?
20F	0	0	4928	11,303	16,231	0	0	25-49	11-34	36-83	60	3.6	Stable?
25C	0	0	8657	4680	13,337	0	0	43-87	5-14	48-101	74	5.5	Stable?
Total	8382 (8%)	7980 (8%)	20,936 (21%)	61,818 (62%)	99,116	168-251	112-136	104-210	62-185	446-782	614	6.2	

[a] Density estimate for each stratum: Super = 20-30 grizzly bears (all ages)/1000 km^2, High = 14-17 grizzly bears (all ages)/1000 km^2, Med = 5-10 grizzly bears (all ages)/1000 km^2, Low = 1-3 grizzly bears (all ages)/1000 km^2.

[b] (Area) x (density estimate for that stratum).

[c] Large blocks of glaciers and area above 6000 ft were excluded as non-bear habitat.

[d] Number of grizzly bears (all ages)/1000 km^2.

Table 2 Percent of grizzly bear population (adjusted for closure) by sex and age in a portion of Unit 20A mountains, spring 1992 (Reynolds, pers commun)

	All bears				Bears > 2 years old		
Age	Female	Male	Unknown	Total	Female	Male	Total
≥ 6	25	9	--	34	11	30	41
2-5	30	19	--	49	23	36	59
≤ 1	--	--	17	17	--	--	--
Total	55	28	17	100	34	66	100

Table 3 Estimated sex and age composition of grizzly bear population in Unit 20A mountains[a], spring 1992

	No. of bears (all ages)				No. bears ≥ 2 years old		
Age	Female	Male	Unknown	Total	Female	Male	Total
≥ 6	34	12	--	46	12	33	45
2-5	40	25	--	65	26	40	66
≤ 1	--	--	23	23	--	--	--
Total	74	37	23	134	38	73	111

[a] Extrapolated using population estimate (Reynolds, pers commun); 1) 16.8 bears of (all ages)/1000 km^2 for 7980 km^2 = 134 bears of all ages; 2) 13.9 bears ≥ 2 years old/1000 km^2 for 7980 km^2 = 111 bears ≥ 2 years old; and composition data in Table 2.

Table 4(a) Unit 20A grizzly bear harvest[a], 1991-1992 through 1993-1994

Regulatory year	Reported							Total estimated kill[d]				
	Hunter kill[b]				Non-hunting kill[c]							
	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	8	2	0	10	0	0	0	8	2	0	10	
Total	12	7	0	19	0	0	0	12	7	0	19	63

[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 4(b) Unit 20B grizzly bear harvest, 1991-1992 through 1993-1994

Regulatory year	Reported							Total estimated kill[d]				
	Hunter kill[b]				Non-hunting kill[c]							
	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	4	5	0	9	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	--

[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 4(c) Unit 20C grizzly bear harvest, 1991-1992 through 1993-1994

Regulatory year	Reported							Total estimated kill[d]				
	Hunter kill[b]				Non-hunting kill[c]							
	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	--

[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 4(d) Unit 20F grizzly bear harvest, 1991-1992 through 1993-1994

Regulatory year	Reported							Total estimated kill[d]				
	Hunter kill[b]				Non-hunting kill[c]							
	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	--

[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 4(e) Unit 25C grizzly bear harvest, 1991-1992 through 1993-1994

Regulatory year	Reported							Total estimated kill[d]				
	Hunter kill[b]				Non-hunting kill[c]							
	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	--

[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 5 Harvest of grizzly bears in 3 harvest zones within Units 20A, 20B, 20C, 20F, and 25C, calendar year 1991 through 1993

Harvest zone	Area (km^2)	Calendar year	No. bears harvested All ages[b]		No. bears harvested ≥2 yrs[c]	3-year mean harvest[a] All ages	3-year mean harvest[a] ≥2 yrs[c]	Harvest density[a]
20A mtns	7980[d]	1991	12		11			
		1992	21	(1)	20			
		1993	14		14			
		Total	47	(1)	45	15.7	15.0	1.9
Eastern half of 20B	12,766	1991	4		4			
		1992	9	(1)	9			
		1993	2	(1)	2			
		Total	15	(2)	15	5.7	5.7	0.5
Combined 20A Flats, Western half of 20B, 20C, 20F, 25C	68,060[e]	1991	14	(2)	14			
		1992	9	(2)	9			
		1993	6		6			
		Total	29	(4)	29	9.7	9.7	0.1
Total	88,806[de]		91	(7)	89	30.1	29.7	

[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 non-bear habitat in glaciers and above 6000 ft.

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

Table 6 Residency of successful grizzly bear hunters, 1991-1992 through 1993-1994, combined Units 20A, 20B, 20C, 20F, and 25C

Regulatory year	Alaska Residents No.	%	Nonresident No.	%	Unknown 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
3-Year total	68	68	26	26	6	6	100

[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.

Table 7 Percentage of grizzly bear harvest[a] taken by time period, 1991-1992 through 1993-1994, combined Units 20A, 20B, 20C, 20F, and 25C

Regulatory year	Percentage of harvest[a] Sep 1-15	Sep 16-30	Sep Total	Oct	Apr	May 1-15	May 16-31	May 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
3-Year total	47	28	71	5	5	7	13	20	87

[a] Excludes bears killed in DLP or illegally.

Table 8 Percentage of grizzly bear harvest[a] taken by transport method, 1991-1992 through 1993-1994, combined Units 20A, 20B, 20C, 20F, and 25C

Regulatory year	Percent of harvest[a]								
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Other/ unknown	*n*
1991-1992	37	7	15	0	4	0	26	11	27
1992-1993	41	5	5	15	0	0	18	15	39
1993-1994	19	29	19	10	0	5	19	0	21
3-Year total	34	11	11	9	1	1	21	10	87

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

LOCATION

Game Management Unit: 20D (5,720 mi^2)

Geographical Description: Central Tanana Valley near Delta

BACKGROUND

Grizzly bears are distributed throughout Unit 20D; however, the Tanana River separates grizzly 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. Grizzly bear habitat in Unit 20D north of the Tanana River is adjacent and similar to habitat described in Unit 20E by Gasaway et al. (1990) for the hills north of the Tanana River. Hunter access to southern Unit 20D is excellent, while hunter access is more limited in northern Unit 20D.

MANAGEMENT OBJECTIVES

In Unit 20D south of the Tanana River, manage a stable bear population to provide a mean annual harvest not to exceed 5% of the estimated population > 2 years old, with a minimum of 60% males in the kill.

In Unit 20D north of the Tanana River, increase the mean annual harvest of grizzly bears to 8-10% of the estimated population > 2 years old, until moose calf survival increases to at least 30 calves:100 cows for 3 consecutive years.

METHODS

Successful hunters were required to have grizzly bears sealed at department offices. Data collected from each grizzly bear included sex, skull length and width, transportation used, date and location of kill, number of days hunted, and hunter name and address. A premolar tooth was extracted from each bear skull to determine age.

RESULTS AND DISCUSSION

Population Status and Trend

North of the Tanana River, the grizzly bear population is naturally regulated because of low human-induced mortality. The grizzly bear population south of the Tanana River receives heavy harvest and is regulated by hunting.

Population Size: Revised grizzly bear population estimates were calculated for Unit 20D in May 1993. The Unit 20D estimate was 181-210 bears, with 143-176 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.

Southern Unit 20D. The southern Unit 20D population estimate was 51-58 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 developed by Reynolds (pers commun) for the Alaska Range, plus 14% cubs and yearlings. This compares with previous estimates of 44-68 bears ≥ 2 years old for the area (DuBois 1993).

During the next 2 years, Reynolds (pers commun) plans to refine Alaska Range grizzly 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 southern Unit 20D population estimate and management objectives should be reviewed and reevaluated.

Northern Unit 20D. The revised northern Unit 20D population estimate is 92-109 bears ≥ 2 years old and 105 to 124 bears. This estimate was based on Gasaway's (1990) grizzly bear density estimates for adjacent Unit 20E of 10.4-12.4 bears ≥ 2 years old\1000 km^2, plus 14% additional cubs and yearlings. Previous estimates for this area were 92 bears ≥ 2 years old (DuBois 1993).

Population Composition: Grizzly 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: Grizzly bears are distributed throughout Unit 20D; however, no specific information on patterns of grizzly bear distribution or movements is available.

Mortality

Harvest:

Season and Bag Limit. The season and bag limit was unchanged during this reporting period and consisted of the following:

South of Tanana River	1 Sep-31 May; 1 bear every 4 regulatory years
North of Tanana River	10 Aug-30 June; 1 bear every year

Board of Game Actions and Emergency Orders. No actions were taken during this reporting period.

Human-induced Mortality. The annual reported harvest by hunters in Unit 20D was higher in both 1992-1993 and 1993-1994 than the average of 6 bears/year (range = 2-9 bears/year) for the previous 7 years. Hunters reported taking 10 bears during 1992-1993, and human-induced mortality was 12 bears. Seven bears were reported taken by hunters during 1993-1994, and estimated mortality was 8 bears. Hunters reported taking 3 bears during fall 1994 and estimated mortality was 4 bears (Table 1).

Combined reported harvest from 1992-1993 through fall 1994 consisted of 70% males, which met the harvest objective of a minimum of 60% males in the harvest (Table 1).

Unit 20D hunting harvest reported during 1992-1993 was 6-7% of the estimated population ≥ 2 years old and estimated total mortality was 7-8% of the estimated population ≥ 2 years old. Hunting harvest reported during 1993-1994 was 4-5% of the estimated population ≥ 2 years old and estimated total mortality was 5-6% of the estimated population ≥ 2 years old.

Southern Unit 20D: Most Unit 20D harvest continued to come from southern Unit 20D. During 1992-1993 and 1993-1994, 70% and 71% of respective reported harvest came from southern Unit 20D (Table 2). Based on southern Unit 20D population estimates, the 1992-1993 harvest of 7 bears is 12-14% of the estimated population > 2 years old. The 1993-1994 reported harvest of 5 bears is 9-10% of the estimated population > 2 years old. Harvest exceeded the management objective both years.

Combined harvest from 1992-1993 through fall 1994 was 67% males (Table 2), which met the management objective of a minimum of 60% males in the harvest.

DuBois (1993) reported that hunters, pilots, and local residents familiar with the area thought bear populations were increasing. During this reporting period, anecdotal reports indicate the bear population is not as high as several years ago.

The southern Unit 20D reported harvest continues to exceed the harvest objective. If the population estimates are accurate, population declines are inevitable.

Northern Unit 20D: Harvest continued to be low in northern Unit 20D. During this reporting period only 5 bears were reported killed (Table 2). Combined harvest consisted of 80% males. Reported harvest was 3% of the estimated population during 1992-1993 and 2% in 1993-1994.

Hunter Residency and Success. No significant changes occurred in residency of Unit 20D bear hunters. All grizzly bears killed during this reporting period were killed by Alaskan residents, and 50% were killed by local residents (Table 3).

Transport Methods. Most transportation types are used to take bears in Unit 20D. Highway vehicles, 3- or 4-wheelers, and foot access were the most commonly used transportation this report period (Table 4).

Harvest Chronology. No significant change occurred in harvest chronology during this report period. In Unit 20D most grizzly bears were taken during the fall hunting season. During the combined 1992-1993 through fall 1994 hunting seasons, 55% of the bears were killed during September and 70% were killed fall season (Table 5).

Natural Mortality: The rate of natural mortality has not been estimated for grizzly bears in Unit 20D but is probably similar to rates reported for adjacent Unit 20A (Reynolds 1990).

CONCLUSIONS AND RECOMMENDATIONS

Southern Unit 20D: Grizzly bear harvest in southern Unit 20D exceeded the management objective and may be causing a reduction in the grizzly bear population in this area. Reynolds (1990) reported that harvest of 11% of bears ≥ 2 years old has depressed grizzly bear populations in the northcentral Alaska Range at a rate of 2% per year. Based on approximations of southern Unit 20D population size, grizzly bears in southern Unit 20D have apparently experienced heavy harvest during this report period and the population may have declined.

Although the grizzly bear harvest in southern Unit 20D may result in a decline in the bear population, it may have a significant benefit for ungulate 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.

No recommendation is being made to reduce grizzly bear seasons and bag limits at this time because the Alaska Board of Game will consider Unit 20D for intensive management of predators and prey at their March 1995 meeting. Reducing predation on the Macomb Caribou Herd is being considered as part of the intensive management proposal. Reducing the grizzly bear population in southern Unit 20D may be one of the intensive management options to reduce predation rates on the Macomb Caribou Herd. Also, more accurate density estimates and population models should be available in the next 2 years to help calculate more precise sustainable harvest levels for southern Unit 20D.

Reduced grizzly bear numbers in southern Unit 20D are cause for concern, but this must be balanced with benefits to achieving moose and caribou population objectives. The harvest of grizzly bears should be monitored closely the next several years.

Northern Unit 20D: The grizzly bear harvest in northern Unit 20D continues to be below the management objective, and the bear population is probably naturally regulated depending on prey availability. The low harvest does not meet the current management objective for this area. No further changes are recommended in the grizzly bear season and bag limit at this time because the season has already been liberalized in the area.

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Table 1 Unit 20D grizzly bear harvest[a], fall 1989 through fall 1994

Regulatory year	Reported							Estimated kill		Total reported and estimated kill			
	Hunter kill				Nonhunting kill[b]								
	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	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	2	0	0	2	0	0	0	1	0	2	0	1	3
1990-1991													
Fall 1990	2	2	0	4	0	0	0	1	0	2	2	1	5
Spring 1991	0	2	0	2	0	0	0	0	0	0	2	0	2
Total	2	4	0	6	0	0	0	1	0	2	4	1	7
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	5	2	0	7	1	0	0	1	0	6	2	1	9
Spring 1993	2	1	0	3	0	0	0	0	0	2	1	0	3
Total	7	3	0	10	1	0	0	1	0	8	3	1	12
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[c]													
Fall 1994	2	1	0	3	0	0	0	1	0	2	1	1	4

[a] There are no permit hunts in Unit 20D.

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

[c] Harvest from 1 July 1994 to 31 December 1994.

Table 2 Annual reported harvest of male and female grizzly bears, north and south of the Tanana River in Unit 20D, 1989 through fall 1994

Regulatory year	South of Tanana				North of Tanana				Unk		
	M	F	Total	%	M	F	Total	%	M	F	Total
1989-1990	1	0	1	50	1	0	1	50	0	0	2
1990-1991	2	3	5	83	0	1	1	17	0	0	6
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[a]	2	1	3	100	0	0	0	0	0	0	3

[a] Harvest from 1 July 1994 to 31 December 1994.

Table 3 Unit 20D grizzly bear successful hunter residency, 1989-1994

Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total successful hunters
1989-1990	3	1	0	0	4
1990-1991	4	3	0	0	7
1991-1992	3	0	0	0	3
1992-1993	6	4	0	0	10
1993-1994	3	4	0	0	7
1994-1995[b]	1	2	0	0	3

[a] Residents of Unit 20D.

[b] Harvest from 1 July 1994 to 31 December 1994.

Table 4 Unit 20D grizzly bear harvest by transport method, 1989-90 through fall 1994

Regulatory year	Percent of harvest									
	Airplane	Horse	Boat	3- or 4- Wheeler	Snowmachine	ORV	Highway vehicle	Foot	Unk	*n*
1989-1990	0	0	50	0	0	0	0	50	0	2
1990-1991	0	0	0	0	0	100	0	0	0	2
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[a]	0	0	0	67	0	0		33	0	3

[a] Harvest from 1 July 1994 to 31 December 1994.

Table 5 Unit 20D grizzly bear harvest chronology percentage by time period, 1989-90 through fall 1994

Regulatory year	Harvest periods							
	Sep	Oct	Nov	Apr	May	Jun	Other	*n*
1989-1990	2	0	0	0	0	0	0	2
1990-1991	2	0	0	0	0	0	0	2
1991-1992	1	0	0	0	4	1	0	6
1992-1993	4	2	0	0	3	0	1	10
1993-1994	4	0	1	0	1	0	1	7
1994-1995	3	0	0	--	--	--	--	3

[a] Harvest from 1 July 1994 to 31 December 1994.

LOCATION

Game Management Unit: 20E (11,000 mi^2)

Geographical 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 to kill wolves. After the program ended, bears were lightly exploited throughout the 1960s and 1970s and the population increased. During the early 1980s, grizzly bear hunting regulations were liberalized and resulted in harvest increases. By the mid-1980s the Unit 20E grizzly bear population was estimated to be 12-16 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 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. Liberalizations included lengthening the season, increasing the bag limit from 1 bear every 4 years to 1 bear per year, and revoking the $25 resident tag fee requirement. Grizzly bear harvests increased from a mean harvest of 3 bears/year during 1966-1981 to an annual mean of 18 bears/year during 1982-1988. Based on the combination of harvest rate, harvest sex ratio, skull size, and average age of the harvested bears, harvest has 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 believed to be related to a reduction in the number of predators per prey animal as moose numbers had slowly increased in areas where bear numbers were decreasing. This interpretation has led to other areas adopting liberalized grizzly bear harvest regulations. There have been no field studies designed to evaluate the effects of hunter-reduced grizzly bear populations on moose and caribou calf survival.

MANAGEMENT DIRECTION

Management Goal

The management goal for Unit 20E brown bears is to provide maximum opportunity to participate in hunting grizzly bears.

Management Objectives

1 Manage to effect temporary reductions in the grizzly bear population or to reduce the extent of bear predation in areas where it is limiting moose population growth (e.g., moose populations are below food-limiting densities with fall calf:cow ratios < 25:100);

2 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 multiprey, multipredator system, we must also consider management goals and objectives of the area's moose and caribou populations. In Unit 20E the management goals and objectives for the area's moose population and for the Fortymile caribou herd are for substantial population increases by the year 2000. Both these prey populations are predator limited, and grizzly bears are the primary predator on newborn caribou and moose calves. For this reason, we are attempting to cause a lower than natural grizzly bear population in Unit 20E through use of liberal harvest regulations. We plan to evaluate the effectiveness of reducing 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 Gary Matson (Matson's Laboratories, Milltown, Mont.) for aging.

I evaluated effects of the Unit 20E grizzly bear harvest on moose calf survival to 5 months of age by conducting the following 2 analyses: 1) calculated a regression of moose calf survival trends (calves/100 cows and calves/survey hour) in central Unit 20E from 1977 to 1981 before liberalized grizzly bear hunting regulations (pretreatment), for the 1982-1994 period after liberalized harvest treatment, and during the entire period in an area that has received little bear harvest historically (control); and 2) compared means of calves/100 cows and calves/survey-hour between pretreatment and treatment and between the treatment and the control areas. I used a t-test to compare the means (Zar 1974) and, as necessary, the Satterthwaite correction for unequal variances. The boundaries of the treatment and control areas were determined using harvest locations and average home range sizes of the Unit 20E grizzly bear population (Boertje, unpubl data).

I evaluated the trend of the Unit 20E bear populations in the treatment area by comparing the kill density (Miller 1990) between 1977 and 1981 with the 1982 to 1994 period using a t-test and the Satterthwaite correction and by calculating regressions of sex ratio and 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 356 and 418 bears (12.9-15.1 bears of all ages/1000 km^2). Since 1982 grizzly bear numbers are thought to have declined in central Unit 20E. This assertion is based on higher than sustainable kill density (3.34 bears/1000 mi^2) and reduced sightings by the public and department personnel. Harvest statistics taken independently do not offer a clear picture of the population trend since 1982. Average age and skull size of harvested males (Figs 1-2) showed a slight decreasing trend but were not significant ($P = 0.417$ and $P = 0.678$, respectively). Average age and skull size of harvested females (Figs 3-4) also showed declining trends but were not significant ($P = 0.310$, $P = 0.193$, respectively). The trend of percentage of males in the harvest slightly increased (Fig 5) 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. The slope of the line indicated the bear population in the treatment area has been heavily hunted.

The areas of greatest harvest are the Middle Fork, West Fork, Dennison Fork, and Mosquito Fork drainages. Bear densities in the remainder of the subunit (the Ladue River, Sixtymile River, and lower Charley River drainages) have not been affected by harvest (kill density = 0.17 bear/1000 mi^2) and probably have remained stable.

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 1 bear every 4 years bag limits 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. Grizzly bear harvest regulations in northern Unit 20D were liberalized to one bear per year in 1992 which could affect the grizzly bear population in adjacent portions of Unit 20E.

Hunter Harvest. During the 1993-1994 regulatory year, hunters reported taking 21 grizzly bears (9 males and 12 females), which represents the largest harvest since 1987 and exceeds the 5-year average of 13.8 bears (Table 1). Grizzly bear harvests substantially increased in 1982-1983 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) even though hunting regulations

remained liberal and hunting pressure increased. The higher harvest during 1993 can be explained by greater hunter effort in areas that have received little hunting pressure in the past. During 1993-1994 males represented 43% of the harvest. The mean percentage of males taken in the harvest during the past 5 years in Unit 20E was 58%.

Since 1982 most grizzly bear harvest in central Unit 20E has occurred in the Dennison, Middle, West, and Mosquito Forks of the Fortymile River and in the upper Charley River drainages (3033.5 mi^2, 7857 km^2). Taking the average home range size of the radiocollared Unit 20E grizzly bears and the sex ratio of the harvest into account, I estimated the actual area affected by the harvest to be 3670 mi^2 (9504 km^2). This area will be referred to as the treated area. Between 1982 and 1993, 146 grizzly bears were harvested (12.2/year) in the treated area. The kill density (no. harvested bears/1000 mi^2) ranged between 1.92 and 4.35 and averaged 3.34 (s=0.91). The kill density increased significantly (P = 0.001) after the grizzly bear harvest regulations were liberalized in 1981.

For comparison, the kill density in Unit 20A averaged 2.22 (66% of the Unit 20E estimate) during the period Harry Reynolds (unpubl data) estimated a 28% decline in the grizzly bear population. Based on calculations by SD Miller (pers commun), the grizzly bear population density in Unit 20E would have to be 20 bears/1000 km^2 to sustain that high a harvest yield. Similarly, taking no more than sustainable yield during 1982-1985 would have required a population density of 30 bears/1000 km^2. Boertje et al. (1987) estimated the 1986 Unit 20E bear density to be between 12 and 16 bears/1000 km^2.

A population density estimate was not determined in Unit 20E before liberalizing the grizzly bear harvest regulations. To estimate the magnitude of the population decline in the treated area, I used the 1981 density estimate from Unit 20A (Reynolds, pers commun; 22.7 bears/1000 km^2) as the pre-1981 estimate for Unit 20E. I believe the 1981 bear densities were comparable between Units 20A and 20E because the quantity and quality of grizzly bear habitat are similar and because both were lightly harvested. Based on that assumption, between 1981 and 1986 the grizzly bear population in the central portion of Unit 20E declined from 216 to 133 bears (38.4%) at an annual rate of 6.4%. The kill density in the remainder of Unit 20E averaged only 0.17/1000 mi^2 and probably had little effect on population trend.

Hunter Residency and Success. During the 1993-1994 season resident hunters took 95% of the grizzly bears in Unit 20E, compared with the 5-year average of 93% (Table 2). Few guides conduct hunts for nonresidents in this area, and current bear hunting regulations are designed to encourage incidental taking of grizzly bears by resident hunters primarily seeking moose and caribou.

Harvest Chronology. During the past 5 years in Unit 20E most grizzly bears were harvested incidentally during August and September (70%) when most moose and caribou hunters were afield (Table 3). Most bears taken during spring were hunted purposefully; May and June were the most popular months.

Transport Methods. During 1993-1994 airplanes (29%) were used by most successful grizzly bear hunters in Unit 20E (Table 4). During the previous 5 years, airplanes (31%) and highway vehicles (28%) were the modes of transportation used by most successful bear hunters. Few bears were taken

by hunters using 3- and 4-wheelers. The few popular all-terrain vehicle trails probably experience so much traffic they are avoided by grizzly bears during periods of greatest use.

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 closed from 1 July through 9 August and 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 exist in this area with the exception of the small communities of Eagle, Boundary, and Chicken and the Taylor Highway. The subunit offers a variety of forbs and berries for grizzly bears; however, there are no arctic ground squirrels and few opportunities for salmon, food types important to grizzly bears in other areas. Habitat diversity has also been affected by the abnormally high level of wildfire suppression during the 1960s and 1970s. Habitat use by grizzly bears 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 fires in this area will only receive monitoring rather than suppression action except under exceptionally severe fire conditions. Recurring wildfires increase habitat heterogeneity of vegetative habitat that may result in increased productivity for bears and other species from which bears derive benefits as predators and scavengers.

Nonregulatory Management Problems/Needs

Research in Unit 20E and other parts of Alaska has 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 reducing a grizzly bear population by 60% would cause a significant increase in moose calf survival (Ballard and Miller 1990). In response to these findings, 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., in press). To further define the effects of bear harvest on moose calf survival, I attempted to compare moose calf survival between the treated area and an area that received little bear harvest and presumably still supports a more natural density of bears (Prindle Volcano, Ladue River, Sixtymile Butte, and the Tower Bluff area). I assumed that wolves would not confound this analysis as wolf densities are estimated to be similar between the 2 areas.

The analysis showed there was a significant increase (P = 0.023) in calf production (calves:100 cows) in the treatment area following the liberalization of harvest regulations; however, there was also a significant increase (slope = 0.92, P = 0.22) in calf survival in the control area during the same time

period (Fig 6). Comparing means of both calves:100 cows and calves/survey hour between the treatment and control areas between 1982 and 1993 showed no significant difference ($P = 0.947$, $P = 0.149$), indicating the increase in calf survival was similar (Fig 7).

Based on these analyses, calf survival in the treatment area with an estimated 38% reduction in grizzly bear numbers was no higher than the adjacent area where the bear population remained at natural densities. Environmental conditions were favorable during the late 1970s through the 1980s based on the trend of most interior and southcentral Alaskan moose and caribou populations. One possible hypothesis is the nutritional content of the vegetation used by moose and grizzly bears responded to favorable environmental conditions. The availability of better quality browse in early spring may have allowed calves to achieve a growth or nutritional level at an earlier age that enabled them to escape predators. Also, if bears were gaining a better quality diet of vegetation, they may not have been as active in seeking out calves.

If this hypothesis was true, bear predation on calves would have a greater effect on ungulate calf survival in years of below average environmental conditions. The weather during the 1990s has not been favorable to ungulates in Unit 20E. To evaluate effects of a hunter-induced bear population reduction on moose calf survival during less favorable environmental conditions, I will repeat this analysis, comparing calf survival during 1990-1995 with that observed during 1980-1989.

Other possible reasons why the reduction in bears did not cause a detectable increase in calf survival are: 1) the treatment effect was not adequate to cause an increase in calf survival; 2) most bears killed by hunters in Unit 20E are of younger age classes that may not have developed as efficient predatory behavior as adults which are less likely to be harvested; 3) the effects of the bear harvest extends further than I hypothesized and calf survival in the control area was actually affected by the treatment; and 4) the burned area in a portion of the control area was large enough to decrease hunting efficiency by predators as reported by Schwartz and Franzmann (1989) on the Kenai Peninsula.

To date there have been 2 areas, Unit 13 and Unit 20E, where bear hunting regulations have been liberalized to purposely reduce bear population size. This was done to reduce predation by bears on moose and to increase calf survival; in neither instance was a corresponding research project initiated to document the outcome. Even after 14 years of using increased harvest to reduce the bear population in Unit 20E to enhance ungulate population growth, we still do not know the level of reduction necessary to meet our objectives, the effects of compensatory predation by bears or wolves after the bear population has been reduced, or if this management technique will only work under certain ungulate densities or environmental conditions. As in Unit 20E, a cause/effect relationship between increased moose calf survival and increased grizzly bear harvest has not been documented in Unit 13 (Miller and Ballard 1992).

Increasing the harvest of predators through conventional hunting and trapping is presently a socially accepted method of predator control. Members of the public believe it works and supports our present programs; they are asking for more bear reduction programs. To be responsible managers of all wildlife species, I believe it is time for us to find out when and how harvest-caused predator reductions affect

ungulate calf survival. To address this problem, I recommend a 3-year calf mortality study in both Unit 20E and Unit 13.

CONCLUSIONS AND RECOMMENDATIONS

Grizzly bear management in Unit 20E has been successful in providing 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 in an area where the grizzly population has been reduced by hunters and in an area where the grizzly bear population is at natural densities.

The estimated fall bear population (356-418 bears) in the entire subunit probably has not changed much since 1981, even under very liberal hunting regulations. However, in the central portion of the subunit harvest increased significantly after 1981 and annual kill densities have ranged from 1.92 to 4.35/1000 mi^2, resulting in an estimated decline (up to 38%) in grizzly bear numbers in that area.

I recommend the current management objectives be retained. However, I also recommend a concurrent research program be initiated to document effects of predation by a reduced bear population on a low density moose population. Following recommendations by Gasaway et al. (1992), I further recommend the area's wolf population be maintained at lower than natural densities to augment the effects of increased bear harvests to allow more rapid recovery of moose and caribou populations. If we find that this method does not benefit moose or caribou calf survival in Unit 20E, we should change management objectives.

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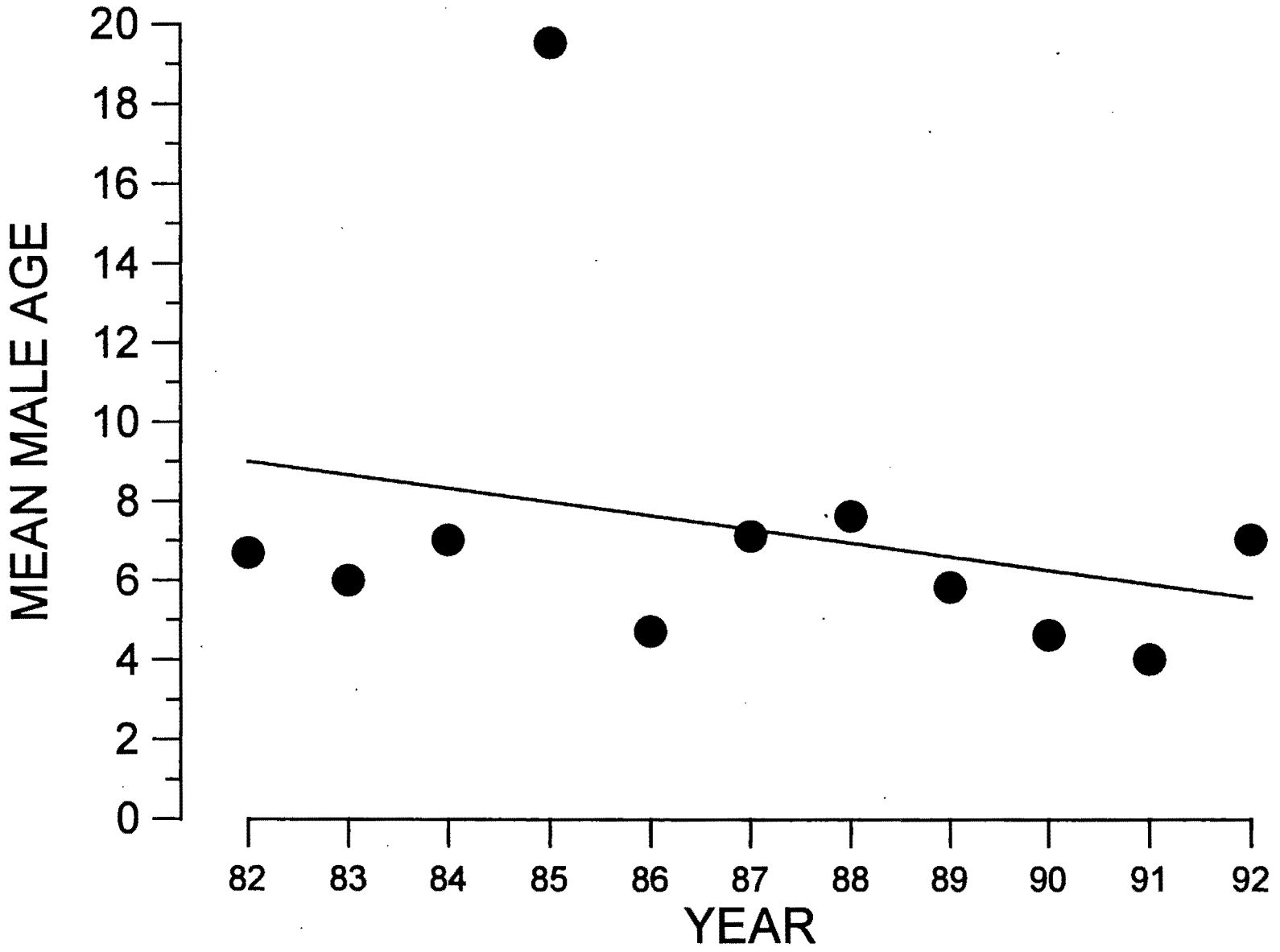

Figure 1 Trend of the mean age of male grizzly bears harvested in Unit 20E, 1982-1992

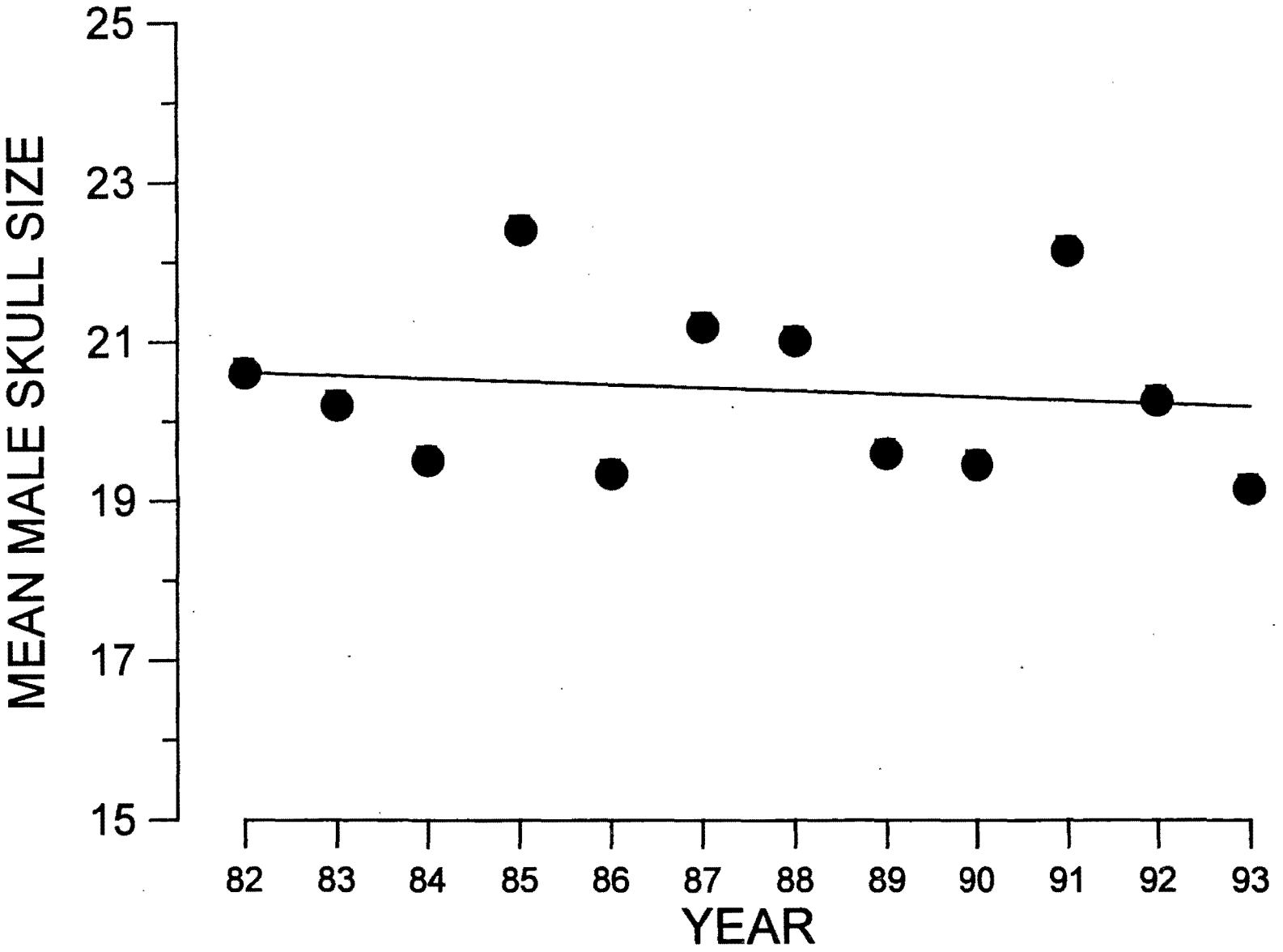

Figure 2 Trend of the mean skull size of male grizzly bears harvested in Unit 20E, 1982-1992

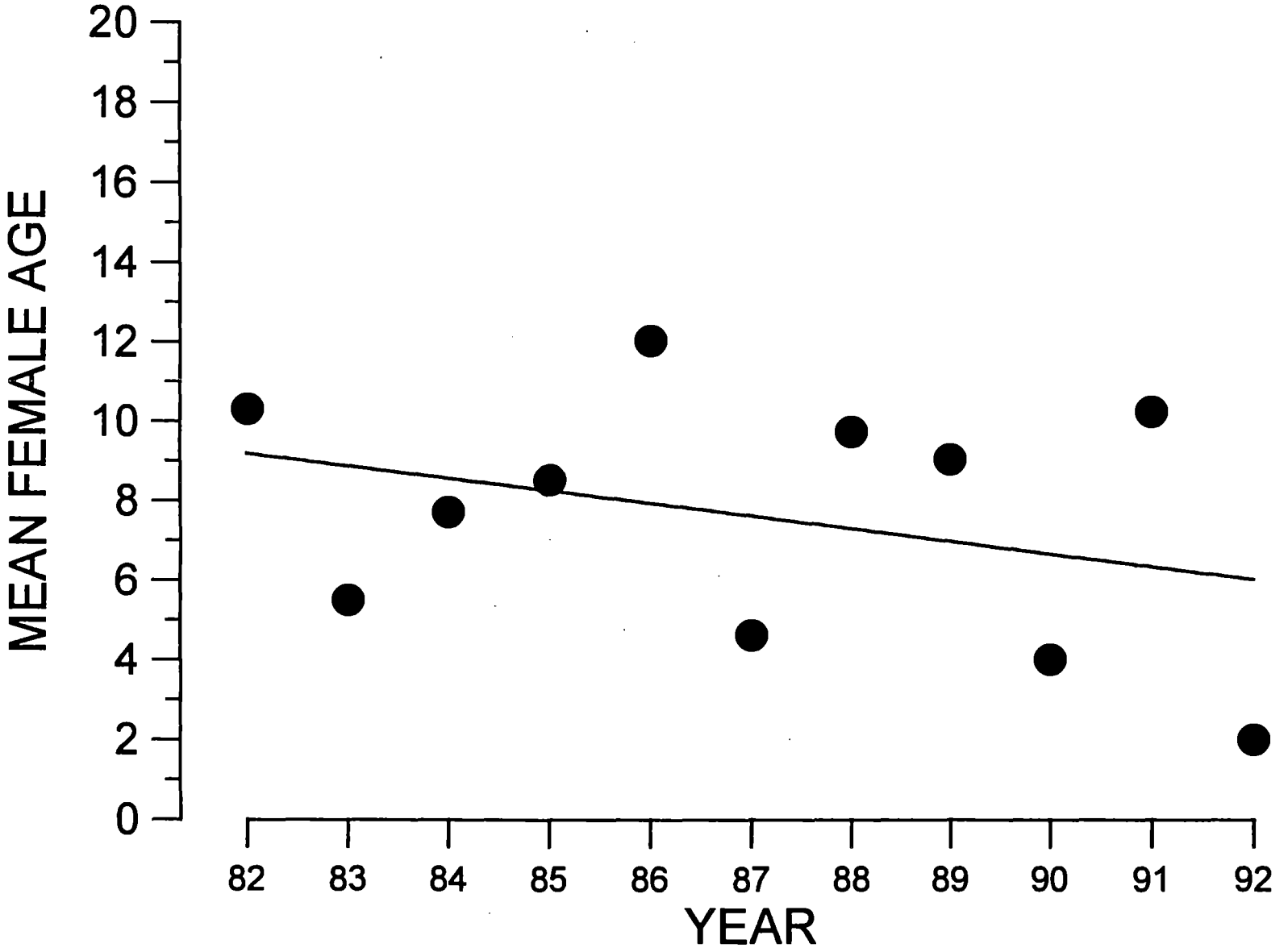

Figure 3 Trend of the mean age of female grizzly bears harvested in Unit 20E, 1982-1992

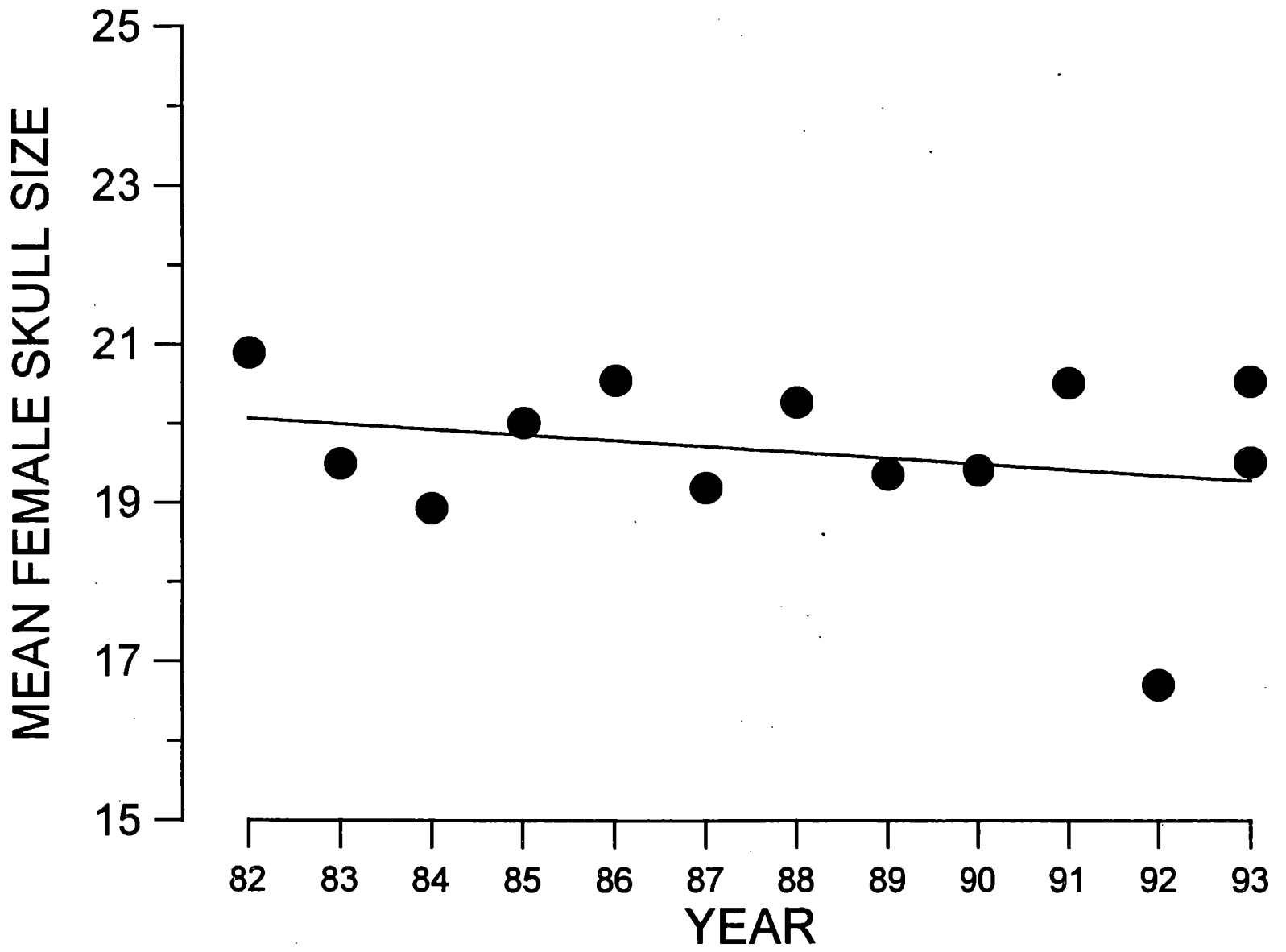

Figure 4 Trend of mean skull size of grizzly bear females harvested in Unit 20E, 1982-1992

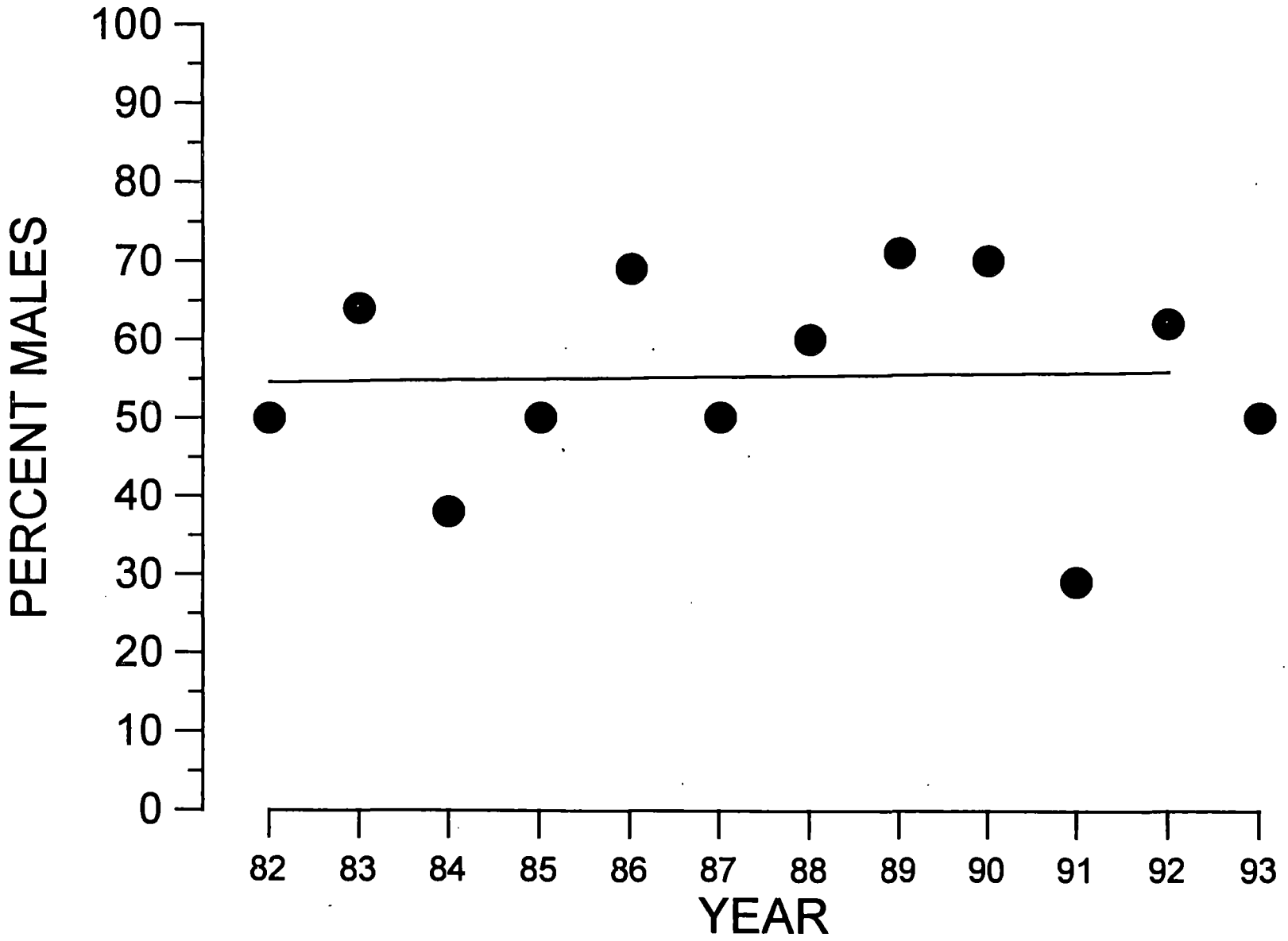

Figure 5 Trend of the percentage of male grizzly bears harvested in Unit 20E, 1982-1992

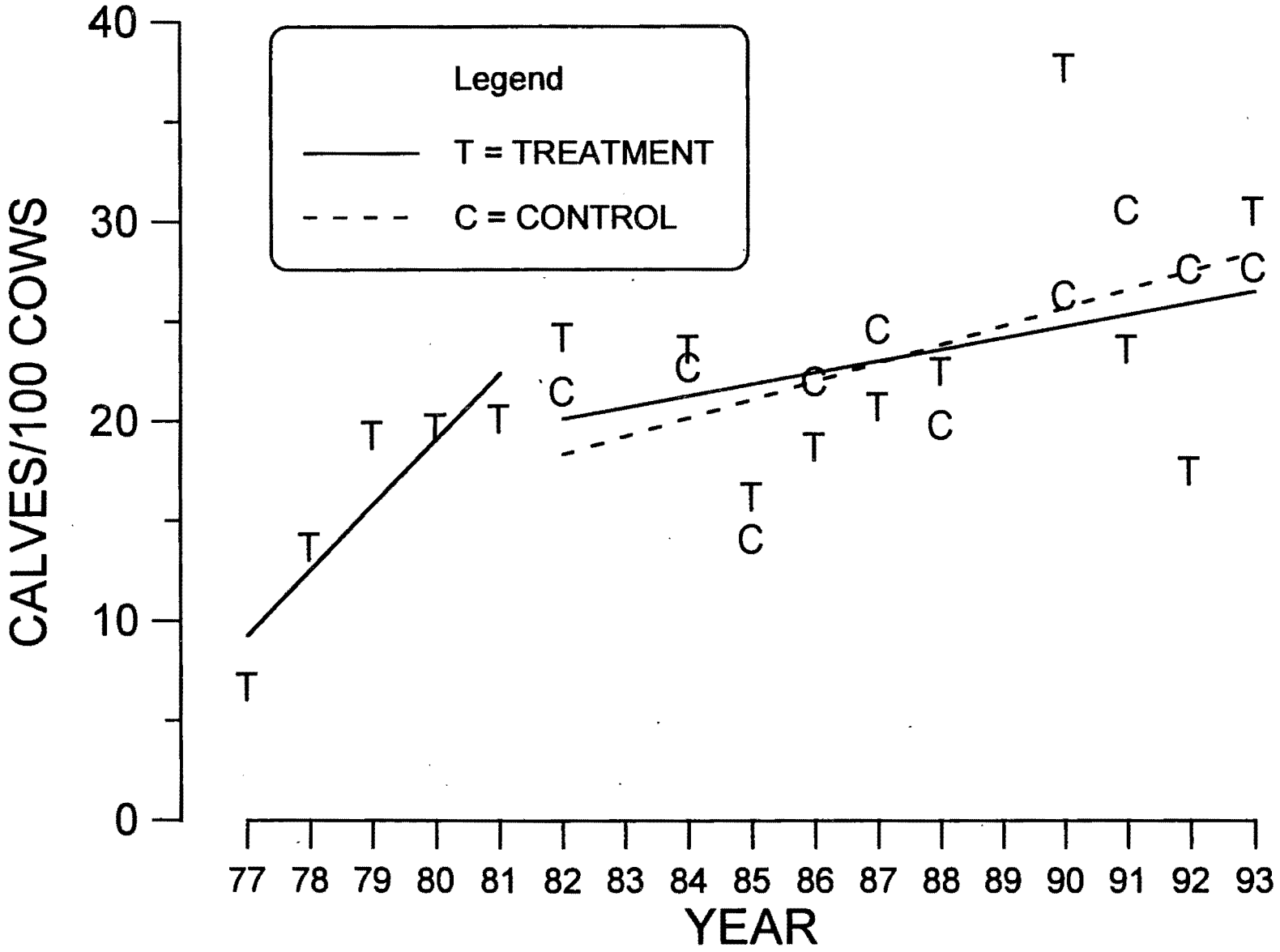

Figure 6 Calf production in treatment (T) and control (C) areas in Unit 20E, 1977-1993

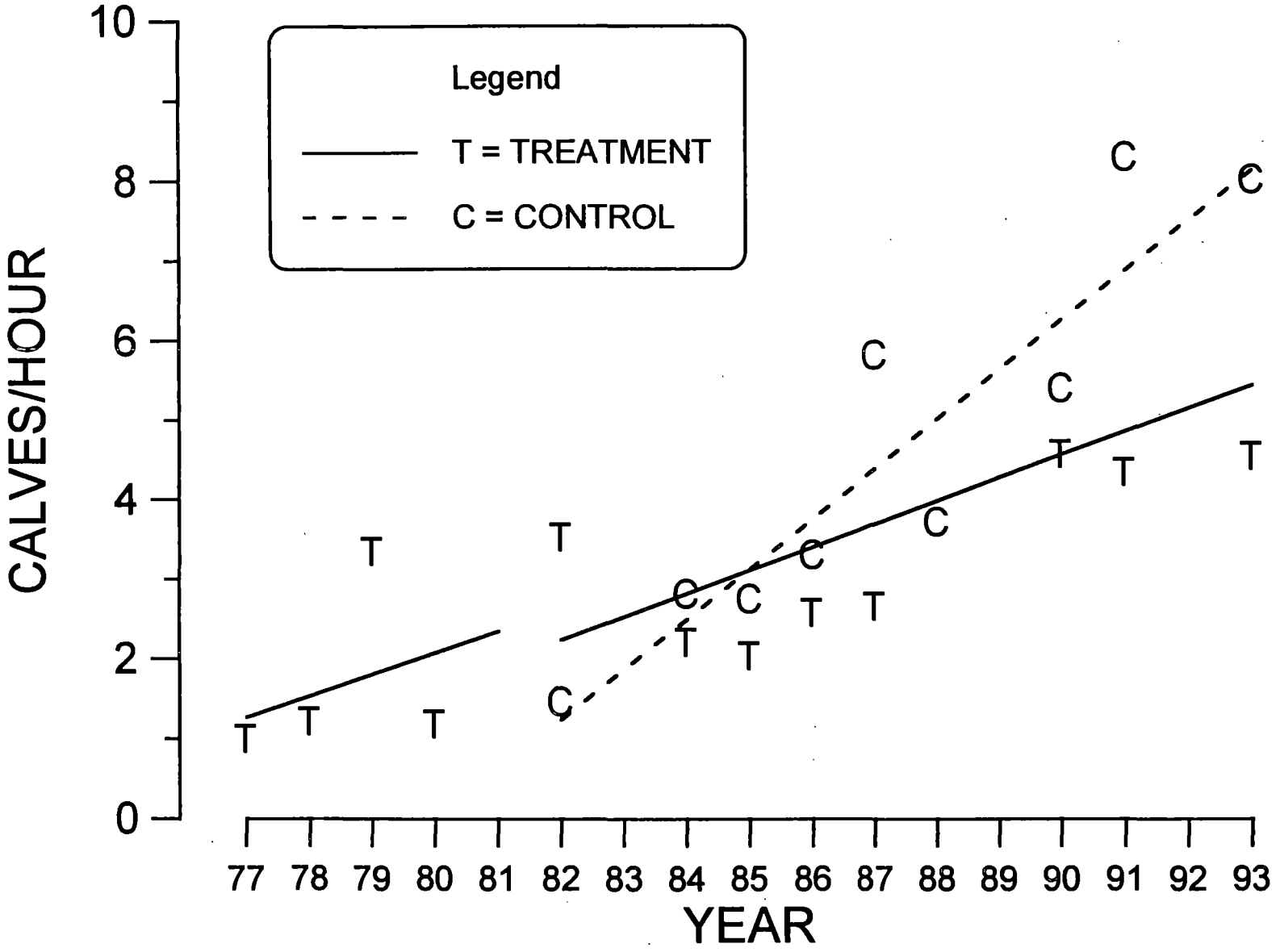

Figure 7 Calf density, as indicated by the number observed/survey hour in treatment (T) and control (C) areas in Unit 20E, 1977-1993

Table 1 Unit 20E grizzly bear harvest, 1989-1994

Regulatory year	Reported							Estimated kill		Total estimated kill					
	Hunter kill				Non-hunting 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[b]															
Fall 1994	6	3	0	9	0	0	0	0	3	8	(75)	4	(25)	0	12

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

[b] Preliminary harvest.

Table 2 Unit 20E grizzly bear successful hunter residency, 1989-1994

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[a]	7	(78)	2	(22)	0	(0)	9

[a] Preliminary harvest.

Table 3 Unit 20E brown bear harvest chronology by time period, 1989-1994

Regulatory year	Harvest periods																*n*
	Aug	(%)	Sep	(%)	Oct	(%)	Nov	(%)	Apr	(%)	May	(%)	Jun	(%)			
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[a]	2	(22)	7	(78)	0	(0)	0	(0)									9
Average %		(23)		(47)		(4)		(0)		(3)		(12)		(11)			

[a] Preliminary harvest.
[b] Excludes 1994.

Table 4 Unit 20E grizzly bear harvest percentage by transport method, 1989-1994

Regulatory year	Percent of harvest									
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Walk	Unk	
1989	40	0	10	0	0	0	20	20	10	10
1990	23	0	15	8	0	0	46	0	8	13
1991	27	0	9	18	0	0	36	9	0	11
1992	43	0	0	21	0	7	29	0	0	14
1993	29	0	10	14	0	19	5	24	0	21
1994[a]	33	0	11	11	0	11	22	11	0	9

[a] Preliminary data.

LOCATION

Game Management Unit: 21 (35,000 mi^2)

Geographical 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 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 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 has been stable or slowly increasing based on field observations, nuisance reports, and hunter sightings during the past 10 years. 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 1 bear/40 mi^2 in the best bear habitat and 1 bear/100 mi^2 in the rest of the area, I estimate the population at 500-600 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 is 25-30 bears. The area does have potential to produce trophy class grizzly bears, with 14 out of 83 bears making the Boone and Crockett minimum skull score of 24 inches during the last 10 years. The number of bears taken at fish camps and not reported is unknown but estimated at a maximum of 10 bears per year.

Seasons and Bag Limits.

Unit 21	1 Sep-31 May	1 bear every 4 regulatory years

Board of Game Actions and Emergency Orders. In 1990 the board simplified the regulations by standardizing the season in the unit for all hunters and aligned the season with that of Units 19, 20, and 24. During periods of liberal regulations, hunters did not respond through increased harvests; the 10-year average annual harvest remains at 8.3 bears.

Athabaskan beliefs may be an important factor for local hunters not responding to the increase in season length. Their relationships to grizzly bears may have more effect on hunting habits than do Fish and Game regulations. Unit residents do not like the bears around their houses and most women are not allowed to eat the meat or come in contact with a bear hide. The seasons are as liberal as possible although the tag fee is still required. Removal of the tag fee might increase the incidental reported harvest to 1-2 animals per year.

Hunter Residency and Success. There is no set pattern of harvest among user groups (Table 2) and most bears are taken during fall moose hunting. The new guide area regulations have 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 on a regular basis to sustain this type of operation, and I suspect harvest will fluctuate with snow conditions.

The harvest by subunit (Table 3) shows that 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 tag fee is removed and hunting habits change, the human harvest will have a negligible effect on grizzly populations in Unit 21. Educational efforts must be made to reduce the present level of unreported harvest.

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Table 1 Unit 21 grizzly bear harvest, 1989-1994

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

[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, 1989-1994

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
Fall 1994	0	3	1	4

[a] Unit residents.

Table 3 Unit 21 bear harvest by subunit, 1989-1994

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
Fall 1994	0	0	3	1	0
Total	7	1	7	20	12

LOCATION

Game Management Unit: 22 (25,200 mi^2)

Geographical Description: Seward Peninsula and that portion of the Nulato Hills draining west into Norton Sound.

BACKGROUND

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 densities of salmon, moose and reindeer.

A 3-year grizzly bear study initiated during spring 1989 in a 2,447 mi^2 portion of the Unit was completed during 1993 (Miller and Nelson 1993). Results of this study have contributed additional data on densities, distribution, productivity, and mortality factors affecting Unit 22 bear populations.

Interest in harvesting bears by recreational hunters, principally from the Nome area, remains high. Reindeer herders report 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:

- 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 harvest.
- Minimize adverse interactions between the public and bears.
- 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 local residents. We summarized harvest data from nonresident permit harvest reports and sealing certificates.

RESULTS AND DISCUSSIONS

Population Status and Trend

Population Size: We believe grizzly bear numbers are stable throughout Unit 22. The bear research study and census provided data regarding the current population size and status of bears within a small portion of Unit 22. However, comparative data for other areas in Unit 22 are unavailable.

We completed a bear census in a 798 mi^2 (2,067 km^2) portion of the 12,509 mi^2 Unit 22 study area during spring 1991. Bears of all ages were calculated at 29.1 bears/1,000 km^2 (95% CI = 26.1 to 33.4) or 75.4 bears/1,000 mi^2 (95% CI = 67.6 to 86.5). Density for bears >2 years old was estimated at 17.9 bears/1,000 km^2 (95% CI = 15.0 to 22.7) or 46.4 bears/1,000 mi^2 (95% CI = 38.9 to 58.8).

The density estimate of grizzly bears >2 years old for the Unit 22 study area was 458 bears (1 bear/27 mi^2). Densities ranged from a high in the western portion of Subunit 22B of 1 bear/20 mi^2 to a low in the southern portion of Subunit 22E of 1 bear/39 mi^2.

Very little data are available on the density of grizzly bears in Subunit 22A and the eastern portion of Subunit 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 the Unit 22 bear population size ranged from approximately 851 bears (1/26 mi^2) to 1086 bears (1/21 mi^2) for bears of all ages. Because of the subjective approach used to calculate the overall density estimate for Unit 22, these estimates should be regarded as tentative.

Mortality

Season and Bag Limit:

Units and Bag Limits	Resident (Subsistence and General Hunts)	Nonresident Open Season
Unit 22A		

All Hunters:		
1 bear every 4 regulatory years	Sept. 1 - Oct. 31	Sept. 1 - Oct. 31
	Apr. 15 - May 25	Apr. 15 - May 25
Unit 22C		
Subsistence/ Resident Hunters:		
One bear every 4	Sept. 1 - Oct. 31	May 10 - May 25
regulatory years.		
Nonresident Hunters:		
One bear every 4 regulatory years by by drawing permit only. Up to 20 permits may be issued in combination with Unit 22B, 22D and 22E.		Sept. 1 - Oct. 31 May 10 - May 25
Remainder of Unit 22		
Subsistence/ Resident Hunters:		
One bear every 4 regulatory years	Sept. 1 - Oct. 31 Apr. 15 - May 25	
Nonresident Hunters:		
One bear every 4 regulatory years by drawing permit only. Up to 20 permits may be issued in combination with Unit 22C		Sept. 1 - Oct. 31 Apr. 15 - May 25

Harvest

Human-Induced Mortality: The Unit 22 harvest of bears taken under current regulations, seasons and bag limits is largely recreational. Limited data indicate subsistence use of grizzly bears in Unit 22 is minimal (Conger et al. 1990). The annual harvest during the 2-year reporting period was 67 bears during the 1992 regulatory year, and 45 bears during the 1993 year (Tables 1 and 2). More bears (56%) 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 more male bears were harvested than females. The reported harvest of the preceding 2 years was no exception. Sex composition of the harvest from fall 1992 through spring 1994 was 66% males and 34% females.

The mean age of bears harvested by hunters has declined since the last reporting period. During 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 fall 1993, the mean age of male bears harvested declined to 5.7 years (n = 41), of females 4.3 years (n = 24), and of all bears combined 5.2 years (n = 66). Heavy harvests in accessible areas have resulted in the removal of many of the larger and older male bears, and hunters are now harvesting younger bears.

Five bears were reported as nonhunting kills 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 an additional 10 to 30 bears were killed annually and not reported in Unit 22.

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 harvests surpasses that of residents. Because nonresident effort throughout the remainder of the unit is restricted by a drawing permit quota (10 in the spring and 10 in the fall), the size of the resident harvest normally exceeds the size of the nonresident harvest (Table 3). The data also indicate that local residents of Unit 22 typically harvest more bears annually than non-local 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 unit residents who have previously hunted bears indicate hunter success is normally higher in the spring, particularly in suitable snow conditions for snowmobile travel and tracking.

Permit Hunts: Nonresidents were required by the Board of Game in 1980 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. Twenty drawing permits (10 in the spring and 10 in the fall) have since been available annually to nonresidents for Units 22B, 22C, 22D, and 22E. Most nonresidents who draw a permit hunt with registered guides. All permits were allocated during the spring and fall seasons the past 2 years.

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 bears are easier to locate and track. During fall access is more limited, and bears are normally more difficult to find.

Transport Methods: The 3 road systems located in Unit 22 make it possible for many bear hunters to reach suitable habitat. Although the data indicate harvests occurring along the road corridors are low (Table 4), hunters frequently use these roads as access points for boats, ORV's 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 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 within the unit 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. Bears continue to be killed and not reported by some rural residents and reindeer herders. 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 in order to improve overall compliance.

Until the size of the local harvest is better documented and current regulations are accepted by the public, any regulatory change which may increase harvest of grizzly bears within Unit 22 should not be implemented.

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Table 1. Unit 22 brown bear harvest[a] for regulatory years 1992 and 1993.

Regulatory year	Reported Harvest											
	Hunter kill				Nonhunting kill[b]				Total kill			
	M	F	Unk.	Total	M	F	Unk.	Total	M	F	Unk.	Total
1992												
Fall 92	14	11	5	30	1	1	0	2	15	12	5	32
Spring 93	21	14	0	35	0	0	0	0	21	14	0	35
Total	35	25	5	65	1	1	0	2	36	26	5	67
1993												
Fall 93	9	9	1	19	1	0	0	1	10	9	1	20
Spring 94	19	6	0	25	0	0	0	0	19	6	0	25
Total	28	15	1	44	1	0	0	1	29	15	1	45

[a] Figures also include permit hunt harvest.
[b] Represents the total known harvest.

Table 2. Unit 22 brown bear harvest by Subunit for regulatory years 1992 and 1993.

Regulatory year	Subunit									
	22A		22B		22C		22D		22E	
	M	F	M	F	M	F	M	F	M	F
1992										
Fall 92	2	6	4	1	4	2	5	3	0	0
Spring 93	6	1	7	3	2	2	5	7	1	1
1993										
Fall 93	2	0	1	3	5	3	2	3	0	0
Spring 94	2	0	11	3	1	1	3	1	2	1

Table 3. Unit 22 brown bear successful hunters[a] by residency for regulatory years 1992 and 1993.

Regulatory year	Local[b] resident	(%)	Nonlocal resident	(%)	Nonresident	(%)	Total successful hunters
1992	32	53	9	15	19	32	60
1993	20	45	7	16	17	39	44

[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 1990 through 1993.

Regulatory year	Harvest							
	Airplane	Boat	Snowmachine	ORV	Highway vehicle	Walk	Unknown	*n*
1990	8	4	6	3	4	0	20	45
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

LOCATION

Game Management Unit: 23 (43,000 mi^2)

Geographical Description: Kotzebue Sound and Western Brooks Range

BACKGROUND

In 1961 the department established grizzly bear hunting regulations and sealing requirements in Unit 23. These regulations were created under the assumption the primary use of grizzly bears is trophy hunting. However, Inupiat hunters in inland communities of Unit 23 have traditionally harvested grizzly bear for meat and hides. In response to frustration expressed by the public over hunting regulations for brown bears and other species, department staff began an extensive regulation review in Unit 23 in 1986. This review, and the department's recognition of local harvest methods, led to the establishment of the Northwest Alaska Brown Bear Management Area and a registration permit hunt in 1992. This hunt allows state residents to harvest 1 brown bear a year under permit conditions.

Biological research on grizzly bears in Unit 23 is limited to a baseline study on the density, movements, and productivity of bears in the vicinity of the Red Dog Mine (Ballard et al. 1991). This study was conducted in cooperation with the National Park Service (NPS) from 1986-90. The primary objective was to determine the density of grizzly bears in the area proposed for development of the Red Dog lead-zinc mine. A census conducted in 1987, 3 years before the mine went into full production, found a density of 1 adult bear (>2.5 years) per 25.7 mi^2 in the study area. A postdevelopment census, part of the original study plan, has not been conducted. The NPS has continued to relocate most of the bears 2-3 times a year to collect additional information on productivity, mortality, and habitat use.

MANAGEMENT DIRECTION

Objectives

1 The primary objective is to maintain a minimum density of 1 adult bear per 30 mi^2 in the Noatak drainage. A census, comparable to that of 1987, should be conducted by 1997 or before any further mining development.

2 Develop a technique to assess trends in brown bear abundance. Costs and impact on animals should be considerations. The technique should be statistically valid and repeatable at 3 to 5-year intervals. Results will be used to alert biologists to potential problems in individual areas within Unit 23.

3 Develop an alternate harvest reporting system by 1996 that will improve the accuracy of harvest data and be socially acceptable to rural residents. Development of an alternate harvest reporting system will require a means of evaluating the system's accuracy, feasibility, and cost effectiveness.

METHODS

In the fall of 1992, department staff visited villages in the region to publicize the Northwest Alaska Brown Bear Management Area registration hunt and issue permits. Efforts were made to personally contact prospective hunters and inform them of the new hunt and permit conditions. We sent reminder letters to hunters who had not returned harvest reports; these were followed by phone calls. In 1993-94 blank registration permits were mailed to individuals that had registered in the 1992-93 hunt to facilitate participation.

Harvest information was derived from sealing documents and harvest reports. We based the population status of bears in Unit 23 on information from unit residents and staff observations.

RESULTS AND DISCUSSION

Northwest Alaska Brown Bear Management Area Registration Hunt

Participation in the new hunt was primarily by residents of the hunt area (Table 1). By publicizing the hunt the first year, we think the number of subsistence bear hunters who participated in the state regulation system increased. In the second year, 43 people of the 87 hunters who obtained permits the first year participated in the hunt. Forty-three additional individuals, primarily from the villages of Noatak, Noorvik, and Kotzebue, obtained permits. Several unsuccessful hunters expressed support for the new hunt in the comment section of their harvest report. The license requirement prevented several hunters from obtaining a permit. Participation from upper Kobuk villages of Kobuk, Shungnak, and Ambler, where subsistence use of brown bears is high, was noticeably low.

Most bears harvested by registration permits in the Northwest Alaska Brown Bear Management Area were taken in Unit 23 (Table 2). In 1992-93 harvest was evenly divided between spring and fall (Table 3). In 1993-94 most of the harvest occurred in spring. Of the 19 bears taken in the first 2 years of this hunt, only 1 hunter requested the hide be sealed. It appears the permit stipulations have been successful in discouraging trophy hunters from hunting under the guise of subsistence.

Population Status and Trend

According to hunters and residents, grizzly bears in most areas are abundant and stable at levels reached between 1990-92. Without recent census data or a low-cost method to assess brown bear numbers, we have no quantitative means to determine population status or trend. As of July 1994, 24 radiocollared females were in the study area. Data from the radiocollared sample of bears were

not useful in determining population trends due to the small number of animals collared and limited number of relocations. NPS plans to remove radio collars from the remaining collared sample of bears in spring of 1995.

Mortality

Harvest:

Season and Bag Limits:

The open sport season in Unit 23 for resident and nonresident hunters from 1992-1994 was 1 Sep -10 Oct and 15 Apr-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 only; 25 permits were issued (7 spring and 18 fall).

Board of Game Actions and Emergency Orders. The Board of Game established a Northwest Brown Bear Management Area and a subsistence season at the spring 1992 Board meeting. The new season went into effect July 1, 1992. Under the new regulations residents are allowed to harvest 1 bear a year from September 1 through May 31. Aircraft are not allowed for transportation to the field and all meat must be salvaged for human consumption. Hides and skulls need not be salvaged; however, if the hide is salvaged and transported out of the Management Area, it must be sealed. The head and paws are removed at the time of sealing to destroy the hides' trophy value.

Human-Induced Mortality. In 1992 hunters killed 48 bears (34 males and 14 females). Seven of these bears were harvested under the new subsistence registration hunt in Unit 23. Five additional bears were killed in defense of life or property (DLP). In 1993 hunters killed 36 bears (29 males and 6 females). Four of these 36 were taken during the registration hunt. There was only 1 DLP bear reported killed in 1993 (Table 4).

As in previous years, hunters harvested a larger percentage of males in the spring. Given the low percentage of the actual harvest reported by local hunters, the value of sex and age analysis is questionable. Indicators based on sex and age of harvested bears are not very sensitive. They lag behind real changes in the population because larger and older animals are sought by hunters (Miller and Miller, 1988). As in past years, most of the harvest occurred during September and April (Table 5). In both years most of the harvest (73%-76%) occurred in the Noatak and Wulik River drainages, north of Kotzebue.

Hunter Residency and Success. Unit 23 residents reported taking fewer bears than nonunit 23 residents (12 versus 36 in 1992, 10 versus 26 in 1993). Noncompliance with harvest reporting by local residents is high, making actual harvest levels and hunter success indicators difficult to interpret.

Transportation. As in past years most hunters used aircraft to access hunting areas (67% in 1992-93 and 64% in 1993-94) (Table 4). The next commonly used form of transportation was snow-

machines during spring hunts (13% in 1992-93 and 30% in 1993-94). Six successful hunters used 3- or 4-wheelers in 1992-93; 1 successful hunter used this means of transportation in 1993-94.

CONCLUSIONS AND RECOMMENDATIONS

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

2. Develop a low-cost method to monitor bear population trends such as the use of a line-intercept track sampling technique (Becker 1991) or densities of den sites.

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

4. Continue efforts to inform local residents of the new subsistence grizzly bear regulations. Efforts should be concentrated in the upper Kobuk villages. In addition to having registration permits available through vendors, issuing permits by phone should be attempted. Consideration should be given to issuing hunters subsistence permits without requiring a current hunting license at that time.

5. Recensus the Red Dog area before any further expansion of the mine occurs.

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Table 1. Permits issued by hunter residency for Northwest Alaska Brown Bear registration hunt 1992-1993.

Regulatory Year	No. Permits issued by hunter unit residence					No. Hunters reporting	
	23	24	26A	Other	Total	Total	Percent
1992-93	65	10	14	4	93	81	87%
1993-94	63	9	9	6	87	73	84%

Table 2. Brown bears harvested during Northwest Alaska Brown Bear Management Area registration hunt, 1992-93.

Regulatory Year	Harvest				Harvest by unit		
	M	F	Unknown	Total	23	24	26A
1992-93	9	3	0	12	10	1	1
1993-94	6	0	1	7	4	2	1

Table 3. Chronology of bears harvested during the first two years of the Northwest Alaska Brown Bear Management Area registration hunt, 1992-93.

Regulatory Year	No. of bears harvested by month									
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
1992-93	5	1	-	-	-	-	1	5	-	12
1993-94	1	1	-	-	-	-	-	4	1	7

Table 4. Unit 23 grizzly bear harvest[a], 1985-93.

Year	Reported kill						Nonhunting kill			Total estimated kill				
	M	(%)	F	(%)	Unk.	Total	M	F	Unk.	M	(%)	F	(%)	Unk.	Total
1985															
Fall 85	7	(64)	4	(36)	2	13									
Spring 86	7	(78)	2	(22)	0	9									
Total	14	(70)	6	(30)	2	22	1	3	1	15	(62)	9	(38)	3	27
1986															
Fall 86	11	(55)	9	(45)	0	20									
Spring 87	11	(85)	2	(15)	0	13									
Total	22	(67)	11	(33)	0	33	1	2	1	23	(64)	13	(36)	1	37
1987															
Fall 87	12	(63)	7	(37)	1	20									
Spring 88	3	(100)	0		0	3									
Total	15	(68)	7	(32)	1	23	0	0	0	15	(68)	7	(24)	1	23
1988															
Fall 88	11	(73)	4	(27)	0	15									
Spring 89	14	(78)	4	(22)	1	19									
Total	25	(76)	8	(24)	1	34	2	0	0	27	(77)	8	(23)	1	36
1989															
Fall 89	9	(50)	9	(50)	2	20									
Spring 90	10	(91)	1	(9)	0	11									
Total	19	(66)	10	(34)	2	31	2	3	0	21	(62)	13	(38)	2	36
1990															
Fall 90	9	(47)	10	(53)	0	19									
Spring 91	14	(82)	3	(18)	0	7									
Total	23	(64)	13	(36)	0	36	1	1	1	25	(64)	13	(33)	1	39

Table 4. Continued

Year	Reported kill M	(%)	F	(%)	Unk.	Total	Nonhunting kill M	F	Unk.	Total estimated kill M	(%)	F	(%)	Unk.	Total
1991															
Fall 91	10	(62)	5	(31)	1	16									
Spring 92	15	(79)	4	(21)	0	19									
Total	25	(71)	9	(26)	1	35	1	0	0	25	(69)	10	(28)	1	36
1992															
Fall 92	22	(65)	12	(35)	0	34									
Spring 93	7	(100)			0	7									
NWA Area	5	(71)	2	(29)	0	7									
Total	34	(71)	14	(29)	0	48	4	1	0	40	(75)	16	(25)	0	53
1993															
Fall 93	15	(79)	4	(21)	0	19									
Spring 94	12	(92)	1	(08)	0	13									
NWA Area	2	(67)	1	(25)	1	4									
Total	29	(83)	6	(14)	1	36	1	0	1	29	(76)	6	(16)	1	38

[a] Includes spring and fall nonresident permit hunts.
[b] Includes Defense of Life or Property kills, research mortalities, and other human-caused accidental mortality.

Table 5. Chronology of Unit 23 grizzly bear harvest[a] by number and percent (in parentheses) during 1985-93.

Regulatory year	August	September	October	April	May	Unknown	Total
1985-86		13 (59)	-	4 (18)	5 (23)	0	22
1986-87		20 (61)	-	8 (24)	5 (15)	0	33
1987-88		17 (74)	3 (13)	1 (4)	3 (9)	0	23
1988-89		13 (38)	2 (6)	12 (35)	7 (21)	0	34
1989-90	1 (3)	16 (52)	3 (10)	7 (23)	4 (13)	0	31
1990-91		18 (50)	1 (3)	14 (39)	3 (8)	0	36
1991-92		15 (43)	1 (3)	16 (46)	3 (8)	0	35
1992-93		34 (71)	2 (4)	12 (25)	0	0	48
1993-94		19 (53)	0	14 (39)	3 (8)	0	36

a Includes nonresident permit hunts but excludes nonhunting mortalities.

Table 6. Unit 23 grizzly bear harvest[a] by hunter residence, 1985-93.

Regulatory year	Local resident[b]	Nonlocal resident	Nonresident	Total
1985-86	9 (41)	3 (14)	10 (45)	22
1986-87	6 (18)	12 (36)	15 (45)	33
1987-88	4 (17)	10 (43)	9 (39)	23
1988-89	17 (50)	8 (24)	9 (26)	34
1989-90	9 (29)	9 (29)	13 (42)	31
1990-91	12 (33)	11 (31)	13 (36)	36
1991-92	9 (26)	14 (40)	12 (34)	35
1992-93	12 (25)	27 (56)	9 (19)	48
1993-94	10 (28)	14 (39)	12 (33)	36

[a] Includes nonresident permit hunts and excludes nonhunting mortalities.
[b] "Local resident" defined as a resident of Unit 23.

Table 7. Unit 23 grizzly bear harvest[a] (percent) by transport method, 1985-94.

Regulatory year	Airplane	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Other	Unknown	Total
1985-86	15 (68)	1 (4)	-	5 (23)	-	-	-	-	22
1986-87	19 (58)	7 (21)	-	5 (15)	-	-	1 (3)	1	33
1987-88	17 (74)	4 (17)	1 (4)	-	1 (4)	-	-	-	23
1988-89	13 (38)	3 (9)	-	11 (32)	7 (21)	-	-	-	34
1989-90	21 (68)	3 (10)	-	6 (19)	1 (3)	-	-	-	31
1990-91	23 (64)	5 (14)	1 (3)	7 (19)	-	-	-	-	36
1991-92	21 (60)	2 (6)	-	12 (34)	-	-	-	-	35
1992-93	32 (67)	2 (4)	5 (10)	6 (13)	1 (2)	-	-	2 (4)	48
1993-94	23 (64)	1 (3)	1 (3)	11 (30)	-	-	-	-	36

[a] Includes nonresident permit hunts and excludes non-hunting mortalities.

LOCATION

Game Management Unit: 24 (26,092 mi^2)

Geographical Description: Koyukuk River drainage upstream from the Dulbi River

BACKGROUND

Grizzly bears are in moderate numbers throughout the unit 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 bears/year. An exception to this pattern was in the early 1970s when bear hunting on the Alaska Peninsula was closed on an alternate-year basis; this 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 has increased the number of potential hunters. Historically, bears were an important source of food and hides for local Natives; however, now they rarely hunt bears, except for residents of Anaktuvuk Pass.

MANAGEMENT DIRECTION

Management Goals

The management goals for Unit 24 brown bears are to protect, maintain, and enhance the grizzly bear population and its habitat in concert with other components of the ecosystem.

Management Objectives

The management objectives for Unit 24 brown bears are: 1) 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; 2) reduce nuisance bear complaints, increase sealing compliance, and reduce the unreported harvest of bears in the unit; and 3) 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: I believe the population has been 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 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 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), he estimated the density at 33/1,000 mi^2, and in the remainder of the unit (14,500 mi^2) he estimated the density at 22-33 bears/1000 mi^2. Most of Unit 24 has a fairly substantial ungulate prey base and spawning salmon streams, and Reynolds' (1987) estimate of 770-930 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 10-year average harvest of bears by sport hunters has increased slightly to 11.4 from 10.8 bears per year. The number of bears taken at fish camps and by trappers and not reported is unknown but is estimated to be less than 4 bears annually.

The unit has not produced many Boone and Crockett record book bears during the last 10 years. Only 2 of 114 bears have met the minimum skull score size of 24 inches.

Seasons and Bag Limits.

Units and Bag Limits	Resident Open Season	Nonresident Open Season
Unit 24 that portion in the 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.

The harvest of bears from the northern (Brooks Range) portion of the unit has ranged from 7 to 10 bears in the last 4 years, well under the management objective maximum of 20 bears.

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. All meat must be salvaged; sealing requirements are waived if the hide and skull remain within the management area. There is no fee, and aircraft cannot be used. Results from this regulation are unknown, but interest in obtaining permits so far has been low.

Hunter Residency and Success. Harvest has been stable but as new Guide/Outfitter areas are established, harvests may change. Most bear hunting is now incidental to fall moose hunting by Alaska residents (Table 1 and 2). Very few nonresidents are 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. The mean annual reported and estimated unreported harvest for the entire unit was estimated at 12.5 bears per year. Based on the estimated sustainable harvest rate of 5% to 6% elsewhere in Interior Alaska, a harvest of 39-47 bears could be sustained in this unit. There is some likelihood of localized overhunting. 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 Unit 24 grizzly bear harvest, 1989-1994

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

Table 1 Continued

Regulatory year	Reported							Estimated kill		Total estimated kill			
	Hunter kill				Nonhunting kill[a]								
	M	F	Unk	Total	M	F	Unk	Unreported	Illegal	M	F	Unk	Total
1994-1995													
Fall 1994	6	7	0	13	0	0	0	n/a	n/a	6	7	0	13
Spring 1995	n/a												
Total	n/a												

[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 24, 1989-1994

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
Fall 1994	1	8	4	13

[a] Unit residents.

LOCATION

Game Management Unit: 25A, 25B, 25D, 26B, and 26C (75,000 mi^2)

Geographical 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, caused the application of very conservative management. Units 26B and 26C were closed to brown bear hunting in 1971-1972, and a variety of regulations including drawing permit hunts have since been used to limit harvest and foster an increase in numbers. A conservative harvest objective of 4% to 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 (Reynolds 1992), combined with observations by area residents and others with a long-term familiarity with the area. Harvest data are 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 an increase in the number of brown bears in Units 25A, 26B, and 26C. Bear density is relatively high in these areas. Bear numbers in Unit 25A are stable or increasing. The trend in Units 26B and 26C seems 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 brown bears are more abundant than in earlier years.

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 more accurate 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 the obvious increase in abundance 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 is 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, with 23 brown bears found in an area of 1500 mi^2 (R Shideler, pers commun). The movement of some brown bears from the mountains to the Porcupine caribou herd calving area on the coastal plain has been observed. Brown bears are also known to concentrate near salmon spawning areas on the Sheenjek River in Unit 25A.

Mortality

Harvest:

Season and Bag Limit.

Units and Bag Limits	Resident Open Seasons	Nonresident Open Seasons
Unit 25A within the Hodzana River drainage One bear every 4 regulatory years.	1 Sep-20 May	1 Sep-20 May
Remainder of Unit 25A	1 Sep-20 May	

	Resident Open Seasons	Nonresident Open Seasons
One bear every 4 regulatory years. *Nonresident hunters*: One bear every 4 regulatory years by drawing permit only; up to 36 permits may be issued.		1 Sep-20 May
Units 25B and 25D One bear every 4 regulatory years.	1 Sep-31 May	1 Sep-31 May
Units 26B and 26C *Resident hunters*: One bear every 4 regulatory years. *Nonresident hunters*: One bear every 4 regulatory years by drawing permit only; up to 10 permits may be issued (20 permits total-10 for each unit).	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 1984-1985 and in Unit 26B beginning in 1987-1988.

The need for the nonresident permit system in Units 25A, 26B, and 26C was reevaluated in 1993. The improved status of bear populations, a low level of harvest relative to a conservative estimate of sustainable harvest, and the cumbersome nature of the permit system prompted the department to propose eliminating the drawing permit system for nonresident hunters in Units 25A and 26C. The Board of Game adopted this proposal in March 1994.

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.

The permit system for nonresidents in Unit 26B was left in place because of greater access and hunting pressure and because bear harvests have approached or exceeded a sustainable level in recent years.

Hunter Harvest. The total annual harvest from 1988-89 to 1993-94 ranged from 30 to 49 bears (Tables 2-6). Most were taken in Units 25A, 26B and 26C, where permits were required for nonresident hunters. The overall harvest has been nearly stable in recent years. Increased bear numbers and a gradual liberalization of regulations resulted in harvests higher than during the late 1970s and early 1980s (Table 2) but still below the 5% harvest goal, except in Unit 26B.

The only area where harvests continue to exceed the conservative harvest objective is Unit 26B, where from 9 to 17 bears have been taken in each of the last 6 years. While the harvest exceeded the objective of 13 bears in 3 of the last 5 years, it represents a maximum of 6% of the estimated population. The total harvest in Units 26B and 26C has usually been at or below the harvest objective of 33 bears annually (20 were reported taken in 1993-1994). Reports from hunters and casual observations indicate bears continue to be common in Unit 26B. While it is difficult to know whether increased harvest restrictions are necessary, access and hunting pressure adjacent to the Dalton Highway indicate a need for close monitoring.

The proportion of males in the overall harvest was 59% in 1992-1993 and 60% in 1993-1994. The sex composition of the harvest generally meets the objective of a minimum of 60% males, except in Unit 26B where the proportion of males was 53% in 1992-1993 and 38% in 1993-1994 (Tables 3-6). Most bears are taken during fall hunts.

Permit Hunts. During 1992-1993 and 1993-1994 drawing permits were required for nonresident hunters in Units 25A, 26B, and 26C. The fall, spring, and total harvest in each subunit are given in Tables 7-9. Harvests by permit holders in 1992-1993 and 1993-1994 were 17 and 6, compared with total harvests in the permit areas of 37 and 28, respectively. Most brown bears are taken during fall hunts, except in Unit 26B where the numbers taken in fall and spring are approximately equal (Table 8).

Hunter Residency and Success. Residents accounted for 40% and 28% of the successful hunters in Units 25A, 25B, 25D, 26B, and 26C during the 1992-1993 and 1993-1994 seasons, respectively (Tables 10-13). 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, boats or highway vehicles (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. Two male bears were reported taken in DLP incidents in Unit 26C during fall 1991.

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 sustainable levels. The one area where annual harvest is sometimes greater than the objective is in Unit 26B where 9 to 17 bears have been taken by hunters in the last 6 years. The current harvest objective is 13 bears.

The elimination of the permit requirement for nonresidents in Units 26B and 26C provides an opportunity to establish a management partnership with guides. Increased communication between resource managers and users can foster proper management of brown bear populations under a system far more workable for all concerned. It is important for the department to follow through in making the new system work.

The management of the Unit 26B bear population should be reevaluated because the combined harvest by resident and nonresident hunters is at or slightly above harvest objectives.

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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 @ 5%
25A	21,280	2.8	584	29
25B&D	26,660	2.2	580	29
26B	15,500	1.7	262	13
6C	10,272	3.8	391	19
Total	73,712	2.5	1817	90

Table 2 Human-caused mortality of brown bears in Units 25 and 26, 1988-1993

Unit	Estimated population	Human-caused mortality					
		1988	1989	1990	1991	1992	1993
25A	584	21	15	14	15	17	8
25B&D	580	6	5	5	2	4	2
26B	262	9	16	12	17	14	13
26C	391	7	4	6	12	6	7
Total	1817	43	40	37	46	41	30

Table 3 Unit 25A brown bear harvest[ab], 1989-1994

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

[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 4 Units 25B and 25D brown bear harvest[a], 1989-1994

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

[a] Note whether permit hunt harvest is included or excluded.

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

Table 5 Unit 26B brown bear harvest[a], 1989-1994

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

[a] Note whether permit hunt harvest is included or excluded.

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

Table 6 Unit 26C brown bear harvest[a], 1989-1994

Regulatory year	Reported								Total estimated kill					
	Hunter kill					Nonhunting kill[c]								
	M	F	(%)[1]	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

[a] Note whether permit hunt harvest is included or excluded.

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

Table 7 Unit 25A brown bear harvest data by permit hunt, 1987-1994

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Males	Females	Unk	Total harvest
Fall hunts	1987-1988	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
(283,284,	1988-1989	32	n/a	48	52	9	2	0	11
285)	1989-1990	n/a	n/a	n/a	n/a	n/a	n/a	10	10
	1990-1991	14	43	14	43	5	1	0	6
	1991-1992	11	36	9	54	4	2	0	6
	1992-1993	13	31	0	69	6	3	0	9
(DB 882,883, 884)	1993-1994	10	20	40	40	4	0	0	4
Spring	1987-1988	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
hunts	1988-1989	n/a	n/a	n/a	n/a	0	0	0	0
(292,293,	1989-1990	n/a	100	0	0	0	0	0	0
294)	1990-1991	0	n/a	0	0	0	0	0	0
	1991-1992	3	33	0	66	2	0	0	2
	1992-1993	5	100	0	0	0	0	0	0
(DB 892, 893 894)	1993-1994	0	0	0	0	0	0	0	0
Totals for	1987-1988	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
all permit	1988-1989	n/a	n/a	n/a	n/a	9	2	0	11
hunts	1989-1990	n/a	n/a	n/a	n/a	n/a	n/a	10	10
	1990-1991	14	n/a	n/a	n/a	5	1	0	6
	1991-1992	14	36	7	57	6	2	0	8
	1992-1993	18	50	0	50	6	3	0	9
	1993-1994	10	20	40	40	4	0	0	4

Table 8 Unit 26B brown bear harvest data by permit hunt, 1987-1994

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Males	Females	Unk	Total harvest
Fall hunts	1987-1988	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
(288)	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
(DB 987)	1993-1994	6	50	17	33	0	2	0	2
Spring	1987-1988	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
hunts	1988-1989	n/a	n/a	n/a	n/a	3	0	0	3
(297)	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
(DB 997)	1993-1994	0	0	0	0	0	0	0	0
Totals for	1987-1988	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
all permit	1988-1989	n/a	n/a	n/a	n/a	4	2	0	6
hunts	1989-1990	n/a	n/a	n/a	n/a	n/a	n/a	7	7
	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

Table 9 Unit 26C brown bear harvest data by permit hunt, 1987-1994

Hunt No. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Males	Females	Unk	Total harvest
Fall hunts	1987-1988	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
(289,290)	1988-1989					2	0	0	2
	1989-1990					0	0	2	2
	1990-1991	3				1	0	0	1
	1991-1992	6				3	0	0	3
	1992-1993	5	0	20	80	0	4	0	4
(DB 988, 989)	1993-1994	1	100	0	0	0	0	0	0
Spring	1987-1988	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
hunts	1988-1989		0	0	100	1	0	0	1
(280,298)	1989-1990	0	0	0	0	0	0	0	0
	1990-1991	2	0	0	100	2	0	0	2
	1991-1992	1	0	0	0	0	0	0	0
	1992-1993	2	100	0	0	0	0	0	0
(DB 998, 999)	1993-1994	0	0	0	0	0	0	0	0
Totals for	1987-1988	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
all permit	1988-1989	n/a	n/a	n/a	n/a	3	0	0	3
hunts	1989-1990	n/a	n/a	n/a	n/a	0	0	2	2
	1990-1991	5	n/a	n/a	n/a	3	0	0	3
	1991-1992	7	n/a	n/a	n/a	3	0	0	3
	1992-1993	7	29	14	57	0	4	0	4
	1993-1994	1	100	0	0	0	0	0	0

Table 10 Unit 25A brown bear successful hunter[a] residency, 1985-1994

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

[a] Note whether hunters in permit hunts are excluded.
[b] Includes only residents of the subunit.

Table 11 Unit 25B and 25D brown bear successful hunter[a] residency, 1985-1994

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

[a] Note whether hunters in permit hunts are excluded.

[b] Includes only residents of the subunit.

Table 12 Unit 26B brown bear successful hunter[a] residency, 1985-1994

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

[a] Note whether hunters in permit hunts are excluded.

[b] Includes only residents of the subunit.

Table 13 Unit 26C brown bear successful hunter[a] residency, 1985-1994

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

[a] Excludes hunts requiring permits.
[b] Includes only residents of the subunit.

LOCATION

Game Management Unit: 26A (56,000 mi^2)

Geographical 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. Interest in hunting bears has remained high in Unit 26A. Unreported harvest has been, and continues to be, a significant problem affecting bear management.

MANAGEMENT DIRECTION

Grizzly bear management objectives established for Unit 26A are to: 1) maintain a grizzly bear population of approximately 800 bears or greater, 2) maintain a harvest success rate of least 60%, and 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 taking, skull sizes, and sex/age composition of harvested animals. Hunting activity was summarized by residency of hunters and their methods of transportation. We used informal information from village residents to assess unreported harvest of bears.

For reporting population estimates and harvest summaries, we divided Unit 26A at 159° W longitude into Unit 26A East and Unit 26A West.

Unit 26A is joined with Units 23 and 24 to become the Northwest Alaska Brown Bear Management Area (NABBMA). This management area offers alternate subsistence hunting regulations for residents hunting primarily for food.

RESULTS AND DISCUSSION

Population Status and Trend

Population Size: The most recent bear density information is from June 1992 for the Utukok and Kokolik drainages in Unit 26A West (Carroll 1993). 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 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 are 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 26A

Subsistence/	Subsistence/ Resident Season	Nonresident Season
Resident Hunters:		
One bear every 4 regulatory years	Sept. 1- May 31	
Nonresident Hunters:		
One bear every 4 regulatory years by drawing permit only. Up to 12 permits may be issued in Unit 26A East and 22 permits Unit 26A West		Sept. 1- May 20
Unit 26A within the Northwest Alaska Brown Bear Management Area- One bear every regulatory year. Hunters must register to hunt (Subsistence hunt only)	Sept. 1- May 31	No open season

Board of Game Actions and Emergency Orders. The Board of Game included Unit 26A in the NABBMA subsistence registration hunt for the 1993-94 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 are available on a first-come, first-served basis at the Fairbanks ADF&G office 5 days following the drawings.

Human-Induced Mortality. Twenty-nine bears were sealed during 1992-93. Sixteen bears were killed in Unit 26A West and 13 in Unit 26A East (Table 1). Twenty-six bears were males and 3 were females (Table 2).

Twenty-six bears were sealed during 1993-94. One bear was killed in defense of life or property (DLP) and 2 bears died of unknown causes. Nine bears were killed in Unit 26A West and 17 in Unit 26A East (Table 1). Nineteen bears were males, 4 were females, and 3 were of unknown sex (Table 2).

The reported harvest in 1992-93 and 1993-94 was similar to the number harvested from 1987 through 1990. The high harvests reported in 1990-91 and 1991-92, 32 and 34 bears, respectively, remain the highest harvests for Unit 26A (Table 2).

The unreported harvest of bears by North Slope residents includes at least 4 bears in 1992-93 and 3 bears in 1993-94. This increases the actual harvests to a minimum of 33 and 29 bears in each regulatory year, respectively. Additional unreported bears may have been taken by resident and guided nonresident hunters (Table 2).

For bears harvested during 1992-93, the mean skull size for males was 21.2 inches and 19.0 inches for females; the mean age was 8.3 years for males and 3.0 years for females. During 1993-94 the mean skull size for males was 20.9 inches and 19.0 inches for females; the mean age was 8.0 years for males and 4.3 years for females (Table 3).

Permit Hunts. Bears were harvested under 4 nonresident permit hunts in Unit 26A. Hunts 286 and 295 are for Unit 26A East and Hunts 287 and 296 are for Unit 26A West. The seasons for all permit hunts are the same (1 Sep-20 May), but drawings are held for Hunts 295 and 296 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.

Registration Hunts. In 1992-93 14 hunters registered to hunt in the Northwest Alaska Brown Bear Management Area and 1 bear was harvested. In 1993-94 9 hunters registered and 1 bear was harvested.

Hunter Residency and Success. Of the 29 bears sealed in Unit 26A during 1992-93, 20 were harvested by nonresidents, 8 by nonlocal Alaska residents, and 1 by a North Slope resident. During 1993-94, 12 of 23 bears were harvested by nonresidents, 10 by nonlocal Alaska residents, and 1 by a North Slope resident (Table 5). Nonresident success rate was 80% during 1992-93 and 67% during 1993-94 (Table 4). No data on success rates are available for resident hunters.

Harvest Chronology. During 1992-93 18 bears were harvested during September, 1 in October, 6 in April, and 4 in May. In 1993-94 13 bears were harvested in September, 1 in October, 4 in April, and 5 in May (Table 6).

Transport Methods. Most bear hunters continued to use aircraft as transportation in Unit 26A. During 1992-93 aircraft were used for transportation by 24 hunters and snowmachines by 5 hunters. Fifteen hunters used aircraft during 1993-94, 4 used snowmachines, 3 used boats, and 1 walked (Table 7).

Natural Mortality: No recent estimate of natural mortality for grizzly bears in Unit 26A is available. However, Reynolds and Hechtel (1983) reported mortality rates among offspring accompanied by marked adult females in the western Brooks Range to be 44% for cubs, 9% for yearlings, and 14% for 2-year-olds from 1977-81.

Habitat

Assessment: Most of the brown bear habitat in Unit 26A remains undisturbed and supports a fairly large and growing population of bears. It would be difficult to evaluate many of the food sources for brown bears in Unit 26A, such as herbivorous forage and ground squirrels. At least seasonally, however, increasing numbers of caribou and a stable population of moose represent a large food resource available to bears.

Oil and mineral exploration and development are potential hazards to brown bear habitat. Exploration is 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 critical habitat for brown bears and given special protection.

CONCLUSIONS AND RECOMMENDATIONS

The 1992-93 and 1993-94 reported harvest of 29 and 23 bears was less than that of the previous 2 years. However, if we assume that safe harvest limits should not exceed 4% of the population, the allowable sustained yield is approximately 36-47 bears. The harvest, plus known unreported harvest, was within this limit both years. Hunters and pilots have also reported seeing increasing numbers of bears in Unit 26A in recent years. Therefore, we recommend no regulatory changes.

Moose calf survival has been very low for the last 2 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. If bear predation is a major factor, some liberalization of bear hunting regulations should be considered to reduce bear predation on moose calves.

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 NABBMA with alternate hunting regulations for subsistence users in 1992. The regulations, designed for people who hunt bears for food, eliminate tags and sealing procedures, and allow harvest reports by mail. Hopefully, these regulations will improve harvest reporting and compliance.

One problem not addressed by the current regulatory system or the special management area regulations is that accurate harvest information still depends upon hunters buying licenses and reporting their harvest. Many local hunters do not buy hunting licenses and/or report their harvest. To alleviate this problem and obtain accurate harvest reports, we need a system of collecting information from North Slope residents that is separate from the licensing system.

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Table 1. Reported harvest of brown/grizzly bears in Subunit 26A, 1988-1994.

Subunit	Estimated population size	Harvest of 4%	Reported harvest					
			1988-1989	1989-1990	1990-1991	1991-1992	1992-1993	1993-1994
26A West	400	16	25	12[a]	16	13[a]	16	9
26A East	500-720	20-29	6	14	16[a]	21	13	17
Total	900-1120	36-47	31	26	32	34	29	26[a]

[a] Includes a DLP-killed bear.

Table 2. Subunit 26A brown bear harvest[a], 1985-1994.

Regulatory year	Reported								Unreported est. kill[b]	Total est. kill
	Hunter kill						Nonhunting kill	Total		
	M	(%)	F	(%)	Unk.	Total				
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	Reported								Unreported est. kill[b]	Total est. kill
	Hunter kill						Nonhunting kill	Total		
	M	(%)	F	(%)	Unk.	Total				
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

[a] Permit hunt harvest included.
[b] Includes DLP kills, research mortalities, and other known human caused accidental mortality.

Table 3. Subunit 26A brown bear skull size and age, 1985-1994.

Regulatory year	Mean skull size, inches				Mean age, years			
	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

Table 4. Subunit 26A brown bear harvest data by permit hunt, 1988-1994.

Regulatory year	Permit hunt no.	Permits issued	Number of hunters: Did not hunt n	Did not hunt (%)[a]	Unsuccessful n	Unsuccessful (%)[b]	Successful n	Successful (%)[b]	Number of bears: Male n	Male (%)[c]	Female n	Female (%)[c]	Unknown n	Unknown (%)[c]	Total harvest
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)	0				3
Total		30	10	(33)	7	(35)	13	(65)	10	(77)	3	(23)			13
1991-1992															
1991-1992	286 East	8	0		0		0		8	(100)	7	(88)	0		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)	0		1	(100)	1	(100)	0		0		1
Spring 1992	296 West	1	0		0		1	(100)	1	(100)	0		0		1
Total		22	3	(14)	1	(5)	18	(95)	15	(83)	1	(16)	2	(11)	18
1992-1993															
1992-1993	286 East	8	2	(25)	0		6	(100)	6	(100)	0				6
1992-1993	287 West	14	2	(14)	3	(25)	9	(75)	9	(100)	0				9
Spring 1993	295 East	4	2	(50)	0		2	(100)	2	(100)	0				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

Table 4. Continued.

Regulatory year	Permit hunt no.	Permits issued	Number of hunters: Did not hunt n	Did not hunt (%)[a]	Unsuccessful n	Unsuccessful (%)[b]	Successful n	Successful (%)[b]	Number of bears: Male n	Male (%)[c]	Female n	Female (%)[c]	Unknown n	Unknown (%)[c]	Total harvest
1993-1994															
1993-1994	985 East	8	2	(25)	1	(17)	5	(83)	5	(100)	0				5
1993-1994	986 West	7	2	(29)	4	(80)	1	(20)	1	(100)	0				1
Spring 1994	995 East	4	0		0		4	(100)	4	(100)	0				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

[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. Subunit 26A brown bear successful hunter[a] residency, 1985-1994.

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

[a] Hunters in permit hunts are included.
[b] Local means North Slope residents.

Table 6. Subunit 26A brown bear harvest chronology by time period, 1985-1994.

Regulatory year	August	September	October	November	April	May	June	*n*
1985-1986		6	1	0	0	5	0	12
1986-1987		13	0	0	0	7	0	20
1987-1988		19	0	0	0	3	0	22
1988-1989		17	0	0	0	14	0	31
1989-1990	1[a]	18	1	0	0	7	0	27
1990-1991	1	18	1	0	1	10	0	31
1991-1992	0	25	2	0	3	3	0	33
1992-1993	0	18	1	0	6	4	0	29
1993-1994	0	13	1	0	4	5	0	23

[a] DLP kill.

Table 7. Subunit 26A brown bear harvest[a] percent by transport method, 1985-1994.

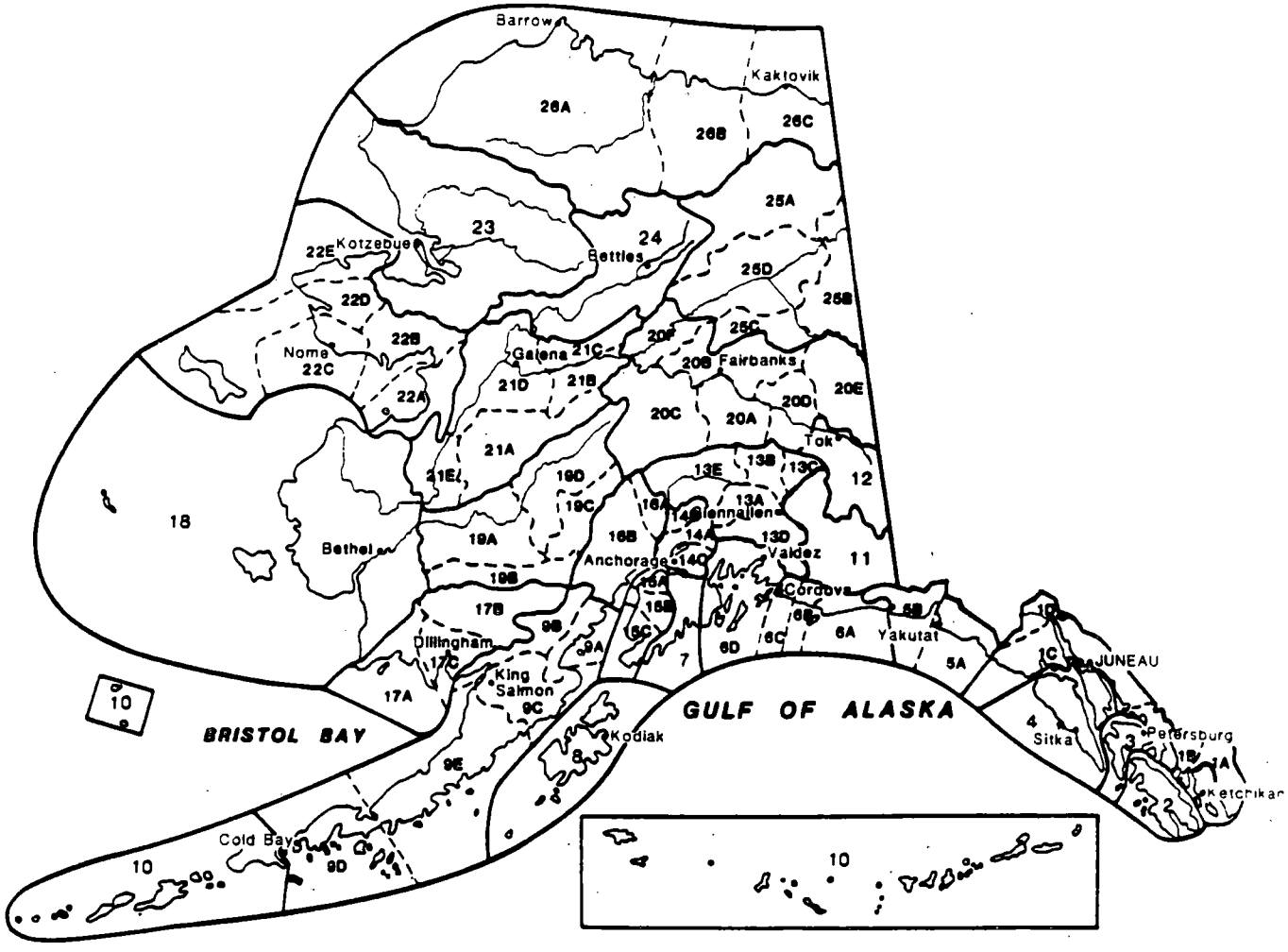
Regulatory year	Airplane		Horse		Boat		Snowmachine		ORV		Walk		Unknown		*n*
	Transport method for harvest (%)														
1985-1986	7	(50)	2	(14)			3	(22)			1	(7)	1	(7)	14
1986-1987	19	(95)							1	(5)					20
1987-1988	20	(92)					1	(4)	1	(4)					22
1988-1989	27	(87)			3	(10)			1	(3)					31
1989-1990	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

[a] Permit hunt harvest is included.

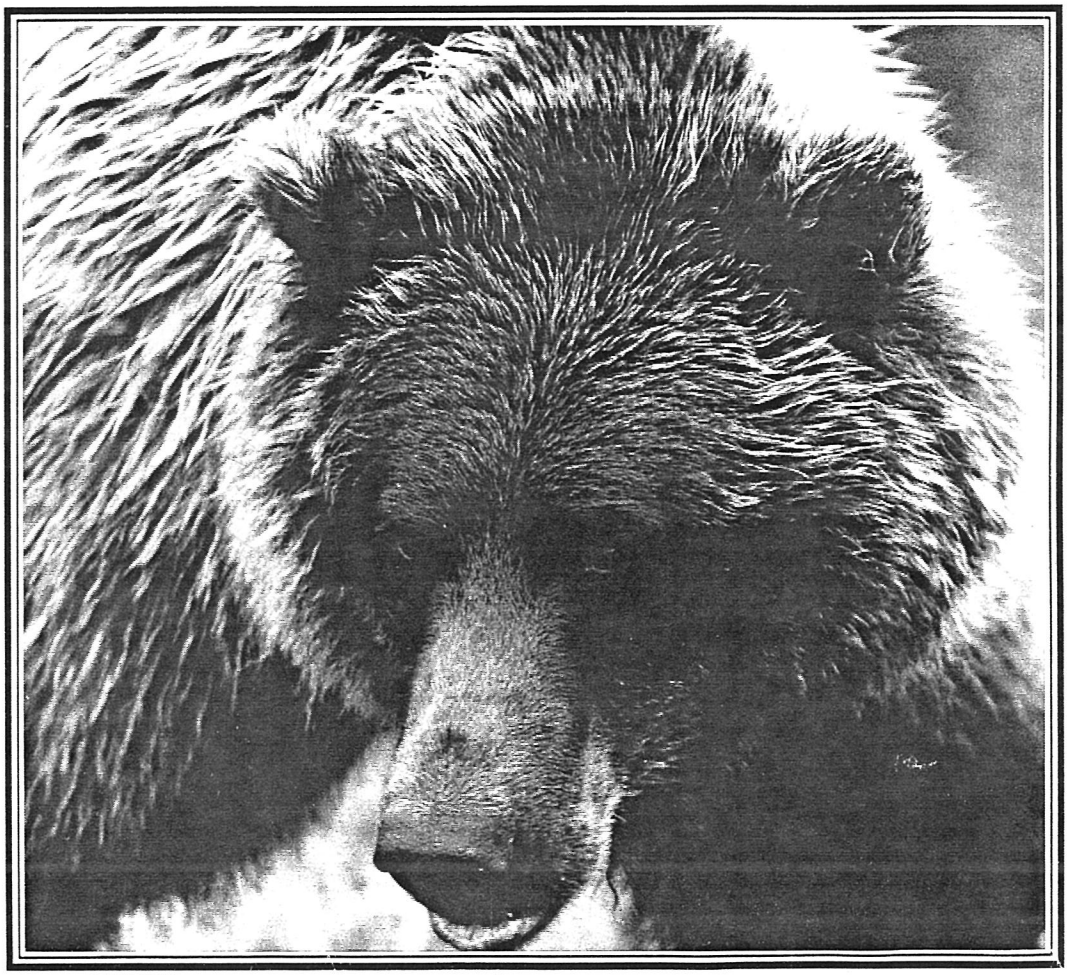
NOTES

NOTES

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.



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