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BROWN BEAR

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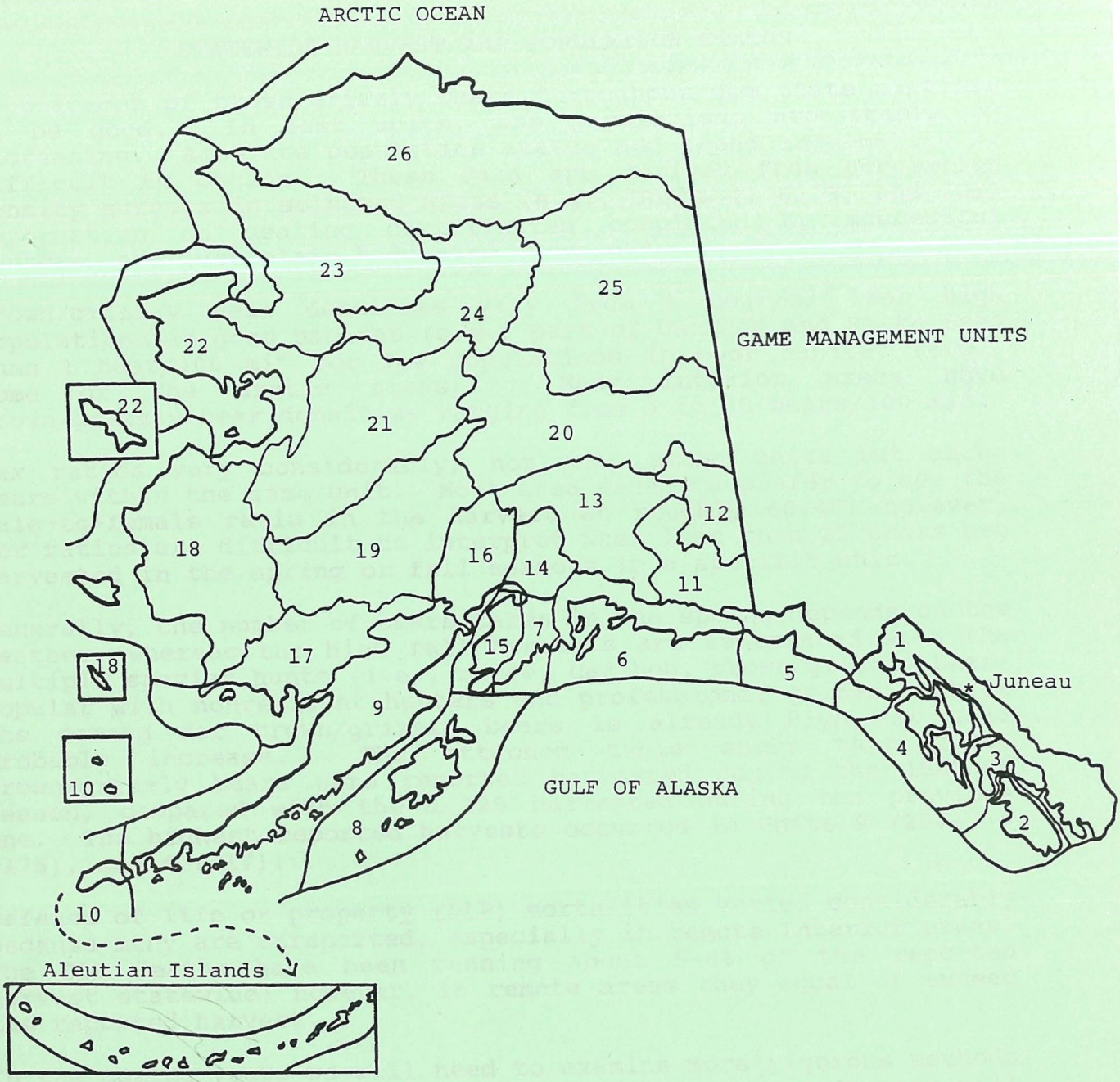
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STATEWIDE HARVEST AND POPULATION STATUS

Populations of brown/grizzly bears throughout the state continue to be good. In most units, the populations are stable or increasing. Accurate population status and trend information is difficult to obtain. These data are derived from population density surveys in selected areas (e.g., Units 4, 8, 9, and 20), information on sealing certificates completed by successful hunters, and just plain "educated guesses."

Brown/grizzly bear densities vary from 1 bear/mi^2 for high populations in good habitat (e.g., part of Units 4 and 8) to less than 1 bear/100 mi^2 for low populations in poor habitat (e.g., some of the arctic areas). Many Interior areas have brown/grizzly bear densities ranging from 5 to 25 bears/100 mi^2.

Sex ratios vary considerably, not only among units but among years within the same unit. Most area managers prefer to see the male-to-female ratio in the harvest at roughly 60:40; however, sex ratios are difficult to interpret when less than 25 bears are harvested in the spring or fall seasons in a specific unit.

Generally, the number of bears taken in the spring depends on the weather, whereas the high fall harvests are associated with the multiple species hunts (i.e., moose, caribou, brown/grizzly bear) popular with nonresident hunters and professional guides. While the demand for brown/grizzly bears is already high, it will probably increase. The attached table shows that 1,095 brown/grizzly bears were reported harvested during the 1987-88 season, compared with the 1,225 harvested during the previous one. The highest reported harvests occurred in Units 9 (254), 8 (175), and 4 (117).

Defense of life or property (DLP) mortalities varied considerably because many are unreported, especially in remote Interior areas. The DLP deaths have been running about 5-6% of the reported harvest statewide; however, in remote areas they equal or exceed the reported harvest.

In the coming years we will need to examine more rigorous methods of interpreting sex and age ratios in the harvest. We also will need to develop methods for collecting information from unsuccessful hunters so that we can estimate a total statewide hunting effort on brown/grizzly bears and allow more fully evaluated population trends. In high-pressure hunting areas we will probably have to develop management quotas and population objectives on a scale much finer than even subunit boundaries, to meet demands placed on unique populations as access increases and hunting and guiding patterns change.

Attaining population objectives in the future will depend on our abilities to educate hunters on how to select for adult male bears, establish season dates that optimize the selection of male bears, regulate hunting effort by commercially guided hunters,

and maintain ample habitat from hunter encroachment and destruction.

Unit	Bears harvested by hunters	Nonsport mortality
1	20	3
4	117	14
5	29	2
6	65[a]	4
7 & 15	13	1
8	175	16
9	254	12
10	2	--
11	6	--
12	12	--
13	67[a]	2
14	17[a]	--
16	59	--
17	45	4
18	2	--
19	34	--
20	43	1
21	5	--
22	28	7
23	18	1
24	15	--
25	31	--
26	38	1
TOTAL	1,095	68

[a] highest on record

STUDY AREA

GAME MANAGEMENT UNIT: 1 (16,950 mi^2).

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

BACKGROUND

In Southeast Alaska the ranges of brown bears and black bears generally do not overlap, except in Unit 1 (i.e., mainland coast) where both species occur in relatively large numbers. While research concerning brown bear habitat use and intensive aerial censuses have been conducted in nearby Unit 4, little work has been done in Unit 1. Hunter harvest data, collected since 1966, and insight gained from hunter interviews have provided the basis for recommendations concerning seasons and bag limits.

POPULATION OBJECTIVES

To maintain an average age of harvested males of no less than 6.5 years and a male:female harvest ratio of at least 3:2.

To reduce the number of bears killed because of garbage habitatuation.

METHODS

All data obtained during this reporting period were gained from mandatory sealing of hides and skulls and anecdotal information from hunters and other observers.

RESULTS AND DISCUSSION

Population Status and Trends

Population information is not available for brown bears in this unit. Information on hunter effort is not currently collected, making it difficult to ascertain population trends using catch per unit effort indices. Beginning in the fall of 1989 seasonal effort data will be available through a registration permit system. Informaton available through the sealing process suggested that the population is stable.

Mortality

Season and Bag Limit:

The hunting season in Unit 1 is from 15 September to 31 May for subsistence, resident, and nonresident hunters. The bag limit is 1 bear every 4 regulatory years.

Human-induced Mortality:

Harvest by subunit is summarized in Table 2. The majority of the brown bear harvest in Unit 1 usually comes from Subunits 1C and 1D, and over the past 5 years these subunits have accounted for an average of 21% and 46% of the harvest, respectively. During this reporting period, the percentage taken from Subunit 1C was at a 5-year low; only 2 bears were taken, representing just 9% of the unitwide harvest. The total harvest (23) was similar to the mean (23.4) for the previous 5-year period. Nonhunting mortalities increased from zero in 1987-88 and one in 1986 to three for 1988. There is no apparent trend in these mortalities.

In 1988 males made up 55% of the known-sex harvest. This was down from the 1983 to 1987 average of 68% and below the management objective of 60%.

The mean skull size for bears taken in 1988 was down slightly from those of previous years (Table 1). Mean age of harvested males (5.7 yrs) was less than that for 1987 (12.4 yrs) and the 1982-87 mean (8.8 yrs). The mean age for females was also down slightly.

Hunter Residency. Nonresident hunters harvested 10% of the bears in 1988. This downward trend has been apparent since the early 1980's.

Harvest Chronology. Although 80% of this year's harvest occurred in the spring, the timing of the harvest has varied over the past several years and, unlike the remainder of Southeast, has rarely favored the spring season.

Transportation Methods. There have been no significant changes in the transportation methods reported by successful hunters. The majority of hunters in Subunits 1A, 1B, and 1C used boats (90%), while hunters in Subunit 1D made frequent use of highway and off-road vehicles and aircraft. Few road access opportunities exist, except in Subunit 1D.

Habitat Assessment

Timber harvest and mineral exploration and development pose the most serious threats to brown bear habitat. The impacts of mining and associated activities on patterns of bear habitat use is being examined on Admiralty Island (Schoen and Beier 1987). Access afforded by logging roads has caused brown bear harvests on northeast Chichagof Island to exceed levels believed to be

sustainable. In addition to habitat loss and increased access, the inherent increase in bear-human conflicts and subsequent defense-of-life-and-property (DLP) mortalities associated with camps and their garbage dumps continue to be a major concern.

CONCLUSIONS AND RECOMMENDATIONS

The management objectives for Unit 1 were not met this year. The percentage of males in the harvest at 55% was slightly below the goal of 60%. The mean age for harvested males (5.7 years) was also less than the desired 6.5 years. Both of these parameters have fluctuated over the years, and this year's figures are probably not a cause for immediate concern. If the 5-year mean for these criteria are considered, the mean age for males (7.9 years) is well above the objective.

The DLP mortality (3 bears) represents an undesirable increase. Two of these brown bears were taking garbage from dumpsters at Chilkoot State Park in Haines; they were destroyed when they became hazardous. Efforts have been made to make this food source unavailable, thereby reducing the likelihood of continued losses at that location. Solid waste will be a persistent problem in other areas where open dumping is occurring. Incineration has proven to be the most effective waste disposal method, because it reduces bear attractants. A consistent and enforceable policy on solid-waste management that minimizes the impacts on both brown and black bears is needed, as timber and mineral development continues to occur in bear habitat.

Regulations governing the use of specific hunt areas by licensed guides are changing because of recent court actions. How this will affect the bear harvest throughout the region is not yet clear. In an effort to maintain tighter controls on harvests and manage bears on a finer scale, a registration permit system has been developed for Units 1-5. Management quotas and population objectives should be developed on a scale much finer than even subunit boundaries, to meet the demands placed on unique populations as access increases and hunting and guiding patterns change.

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Table 1. Brown bear harvest parameters in Unit 1, 1983-1988.

Year	Hunter harvest	Total harvest[a]	Males (%)	Nonresident harvest(%)	Male skull size[b]		Age			
							Males		Females	
					$\bar{X}$	n	$\bar{X}$	n	$\bar{X}$	n
1983	23	28	74	26	23.6	8	10.0	8	--	--
1984	17	18	80	29	20.7	3	5.1	3	11.4	1
1985	22	26	47	23	22.7	6	8.2	5	7.4	3
1986	22	23	62	23	21.6	9	8.3	8	9.9	2
1987	22	22	75	14	24.5	4	12.4	4	6.4	1
1988	20	23	55	10	21.2	10	5.7	10	5.0	6

[a] Includes sport harvest and defense of life and property mortality.
[b] Skull size equals total length plus zygomatic width.

Table 2. Brown bear harvest[a] by subunit in Unit 1, 1983-88.

	1A		1B		1C		1D		
Year	Harvest	% of total	Harvest	% of total	Harvest	% of total	Harvest	% of total	Total harvest
1983	7	25	2	7	5	18	14	50	28
1984	3	17	4	22	5	28	6	33	18
1985	2	8	5	19	7	27	12	46	26
1986	2	9	5	22	7	30	9	39	23
1987	5	23	3	14	3	14	11	50	22
1988	4	17	4	17	2	9	13	57	23
mean	3.3	17	3.8	17	5	21	8.2	46	23.3

[a] Includes sport and DLP kills.

Table 3. Chronology of brown bear sport harvest in Unit 1.

Year	Spring		Fall	
	Harvest	Percentage of total	Harvest	Percentage of total
1983	8	35	15	65
1984	6	35	11	65
1985	11	50	11	50
1986	12	55	10	45
1987	5	23	17	77
1988	16	80	4	25

STUDY AREA

GAME MANAGEMENT UNIT: 4 (5,700 mi^2)

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

BACKGROUND

The majority of Southeast Alaska's brown bears occur in Unit 4 (Johnson 1980). Brown bears are present on the larger islands in the unit and frequently swim to smaller islands.

There are 3 brown bear viewing areas in Unit 4 that are closed to bear hunting: (1) the Seymour Canal Closed Area on eastern Admiralty Island, which includes the Pack Creek Cooperative Management Area; (2) the Salt Lake Bay Closed Area at Mitchell Bay on southwest Admiralty Island; and (3) the Port Althorp Closed Area on northern Chichagof Island (ADF&G 1988). The Pack Creek and Mitchell Bay areas were established for bear viewing in the 1930's (Heintzleman and Terhune 1934).

Brown bear harvests have increased steadily since the mandatory sealing program began in the 1960's. The highest harvest occurred in 1976, when 142 were reported taken by hunters. Brown bear hunting is popular with nonresident hunters, who are required by law to employ registered guides. Brown bear populations are probably highest Admiralty Island (1,664 mi^2). Bear censuses have been attempted on the island since the 1930's, when an estimate of 900 bears (0.6 bears/mi^2) was obtained from track counts (Dufresne and Williams 1932). Mark/recapture efforts in 1988 indicated a population of 0.83 bears/mi^2 (Schoen, pers. commun.). In 1938 and 1939 the U.S. Forest Service used track counts to estimate a population of 940 (0.5 bears/mi^2) on Chichagof Island and 445 bears (0.3 bears/mi^2) on Baranof Island (Heintzleman and Terhune 1934, Klein et al. 1958).

POPULATION OBJECTIVES

To maintain the average age of harvested males at no less than 6.5 years.

To maintain the male:female harvest ratio at no less than 3:2.

To reduce the loss of bears because of garbage habituation through development of joint policies and public education.

METHODS

Bear hunters were required to present the skull and hide of brown bears to a representative of the ADF&G for sealing. Measurements were taken of the length and width of each skull, a premolar was extracted, the hide was examined for evidence of sex, and other pertinent data were noted. Teeth were aged by counting cementum annuli (L. Aumiller, pers. commun.).

An aerial alpine census was accomplished on Admiralty Island in the brown bear research study area utilizing a Piper Supercub aircraft and on northeast Chichagof Island using a Helio-Courier and a Supercub.

Reduction of brown bear loss to defense-of-life-or-property (DLP) incidents was attempted through public education and interagency agreements. To prevent loss of bears to DLP and to promote public safety, Division staff contacted visitors at Pack Creek throughout July and August, explaining regulations of the Pack Creek Cooperative Management Area.

To prevent overharvesting of bears, an emergency season closure was implemented for a portion of Chichagof Island, and recommendations on future harvest were made to the Board of Game. The Board was asked to establish the Northeast Chichagof Controlled Use Area (NECCUA) to facilitate special regulations (Fig. 1).

RESULTS AND DISCUSSION

Population Status and Trend

Based on the analyses of aerial census data and hunter harvest results, brown bear populations on Admiralty, Baranof, and most of Chichagof Island are stable. Bear numbers on the northeast portion of Chichagof Island may be declining, and this area merits special attention. During an aerial survey in July 1988 only 14 bears (14.4 bears/hour) were observed. Increased roading and timber harvest in the area have created access to bear populations that were formerly isolated. Roading has also increased access to salmon streams, bays, and estuaries, resluting in increased bear harvests in those areas.

Three aerial surveys totaling 3 hours and 33 minutes in the 150-mi^2 research study area on Admiralty Island indicated an observed density of 0.83 bears/mi^2 in July 1988 (34.9 bears/hour), compared with 0.96 bears/mi^2 in July 1987 and 1.06 bears/mi^2 in 1986 (J. Schoen, pers. commun.). Admiralty Island contains excellent alpine bear habitat, and populations are thought to be greater than those on the other major islands in Unit 4.

Population Composition:

Regulatory requirements and hunter selectivity combine to cause a high proportion of males in the legal harvest. Many brown bear hunters select for large bears, and regulations prohibit the taking of sows accompanied by cubs.

In Unit 4 the 1988 legal harvest (n = 117) was composed of 71% males, 22% females, and 7% unknowns, compared with the 116 bears legally harvested in 1987; i.e., 76% males, 22% females, and 2% unknowns. Table 1 compares harvest data for the last 5 seasons. The DLP mortality was composed of 57% males (n = 8) and 43% females (n = 6).

The age composition of bears harvested in 1988 is shown in Table 2. The oldest bear taken was a 24.4-year-old male, while the youngest was a 2.4-year-old male. The mean age of harvested male brown bears was 7.1 years (n = 81) in 1988, compared with mean ages of 8.2 (n = 85) and 6.1 (n = 6.3) years in 1987 and 1986, respectively. The mean age of harvested females was 5.2 years (n = 23) in 1988, compared with 6.9 years (n = 23) in 1987 and a mean age of 7.1 years (n = 29) in 1986. Aerial surveys conducted in July 1988 revealed an average of 34% cubs in the Admiralty Island bear research area, compared with 36% cubs in 1987 (J. Schoen, pers. commun.).

Variation in male skull sizes can be an indication of the degree of hunting pressure. Greater harvests may result in a reduction in skull sizes, as large males are selectively removed from the population. The average male skull measurement in 1988 was 22.3 inches for males (n = 83), compared with 22.8 inches (n = 86) for 1987. Males harvested on Admiralty Island averaged 22.8 inches (n = 40) in 1988, compared with 22.4 inches (n = 38) in 1987. Baranof Island bears averaged 22.4 inches (n = 10) in 1988, compared with 23.1 inches (n = 16) in 1987, and Chichagof bears averaged 21.7 inches (n = 32) and to 23.3 inches (n = 33), respectively.

Of the 10 bears killed in defense of life and property in 1988, male skulls averaged 19.7 inches (n = 5), while females averaged 19.5 inches (n = 5). Cubs made up 29% (n = 4) of the DLP total.

Distribution and Movements:

No data were collected. Schoen and Beier (1983) found that telemetered males and females on Admiralty Island (n = 6) had mean home range sizes of 115 km^2 (SD = 75 km^2) and 24 km^2 (SD = 16 km^2), respectively. In an earlier study, Wood (1976) found very little movement of brown bears from Hood Bay on Admiralty Island. Eight of 10 tagged bears were taken by hunters in the drainage where they had been tagged.

Mortality

Season and Bag Limit:

The open season for subsistence, resident and nonresident hunters in Chichagof Island south and west of a line which follows the crest of the island from Rock Point to Rodgers Point, including Yakobi and other adjacent islands; Baronof Island south and west of a line which follows the crest of the island from Nismeni Point to the entrance of Gut Bay, including the drainages into Gut Bay and including Kruzof and other adjacent islands is 15 September to 31 May; the bag limit is 1 bear every 4 regulatory years. The open season for all hunters for the remainder of the unit is 15 September to 20 May; the bag limit is 1 bear every 4 regulatory years.

Human-induced-Mortality:

The total 1988 harvest was 131, including 14 DLP bears and 117 hunter-killed bears. The total take by island was 54 (41%) from Admiralty, 24 (18%) from Baranof, 51 (39%) from Chichagof, one (<1%) from Kruzof, and one (<1%) from Halleck Island. On a mortality\mi^2 basis, Admiralty Island sustained the heaviest harvest (i.e., 1 bear\29 mi^2. Baranof and Chichagof Islands sustained mortalities equaling 1 bear\73mi^2 and 1 bear\41 mi^2, respectively. Bear mortality in the Northeast Chichagof Controlled Use Area (NECCUA) was 1 bear/36 mi^2.

Hunters accounted for 117 (89% of the harvest) brown bears in 1988, the same as the 1987 harvest. The sport harvest by island was 53 (45%) from Admiralty, 18 (15%) from Baranof, 44 (38%) from Chichagof, one (0.5%) from Halleck, and one (0.5%) from Kruzof Island. Table 3 shows the harvest by island and hunter residency.

Defense of Life or Property (DLP). There were 14 bears (11% of the total) killed in DLP incidents in 1988. The DLP mortality by island was one (7%) from Admiralty, six (43%) from Baranof, and seven (50%) from Chichagof. Four brown bears were killed at logging camps, and three were killed in the village of Hoonah on Chichagof Island. On Baranof Island, four were killed at the National Marine Fisheries Service hatchery in Little Port Walter, one was killed in Sitka, and one was destroyed after it had fatally mauled a deer hunter near Port Alexander. One was killed by a camper on Admiralty Island. Two bears that had become nuisances were legally harvested during the season in the communities of Pelican and Port Alexander.

Hunter Residency and Success. Alaska residents took 67 brown bears (57%) in Unit 4, while nonresident hunters accounted for 50 bears (43%). Table 3 shows the harvest by island and hunter residency. Successful residents reported hunting a total of 234 days, averaging 3.5 days each; while successful nonresidents reported a total of 262 days, averaging 5.2 days each (Table 4).

Fourteen hunters (12%) listed mailing addresses in Unit 4, while 53 (45%) listed addresses in other units in Alaska.

Harvest Chronology. The major harvest occurs shortly after bears leave the dens and begin to feed on beach grasses and sedges in the spring. In 1988 a total of 65 bears (56%) were taken between 1 and 20 May (Table 5). Johnson (1980) stated that the optimum hunting period of 20 May through 10 June coincided with high availability and prime fur condition; that period is currently closed to hunting in the eastern two-thirds of Unit 4 (Figure 1).

Spring hunting accounted for 72 bears (62%), while 45 bears (39%) were killed in the fall. The chronology of the harvest has remained fairly consistent for the past 5 years (Table 5); DLP's accounted for 14 bears in the months of June (n = 2), July (n = 2), August (n = 2), September (n = 1), October (n = 6), and November (n = 1).

Transport Methods. Boats were used more (79%) than any other transportation means by brown bear hunters, and land vehicle use declined (Table 6). In 1988 land vehicle users took 5 bears, compared with 14 (12%) in 1987. This may be attributed to the Emergency Order (EO) closing the season on heavily roaded northeast Chichagof Island. Aircraft were used in the harvesting of 12 bears (10% of the legal harvest), compared with 13 bears (11% of the annual total) in 1987 (Table 6).

Game Board Actions and Emergency Orders

An EO was issued to close the season on the Hoonah peninsula on northeast Chichagof Island (Appendix), in response to the overharvesting of brown bears. The increased harvest was associated with improved road access and vehicle use in bear hunting (Young 1989). The Board of Game passed a Division proposal to create the NECCUA (Figure 1), eliminated the fall season, and prohibited the use of motorized land vehicles in that area for brown bear hunting (Appendix).

CONCLUSIONS AND RECOMMENDATIONS

All management objectives were met during the reporting period. The average age of harvested males was 7.3 years, greater than the 6.5-year objective. The male:female harvest ratio was 6:2, which exceeded the minimum objective of 3:2. The 3rd objective was to reduce the loss of bears because of garbage habituation through development of joint policies and public education. While the DLP mortality increased during the period, it was not related to garbage problems. The Division of Wildlife Conservation should continue to work with the U.S. Forest Service and the Alaska Department of Environmental Conservation to use the Department's permit review authority to bring logging camps and communities into compliance with the interagency joint policy statement (Young 1989).

Increasing problems with vehicle access created by the construction of logging roads led to the issuance of an EO closing the brown bear season on the Hoonah peninsula on Chichagof Island and the creation of the NECCUA. A number of DLP mortalities occurred after the EO was issued. The spring season should be closely monitored and closed by EO when a quota has been reached.

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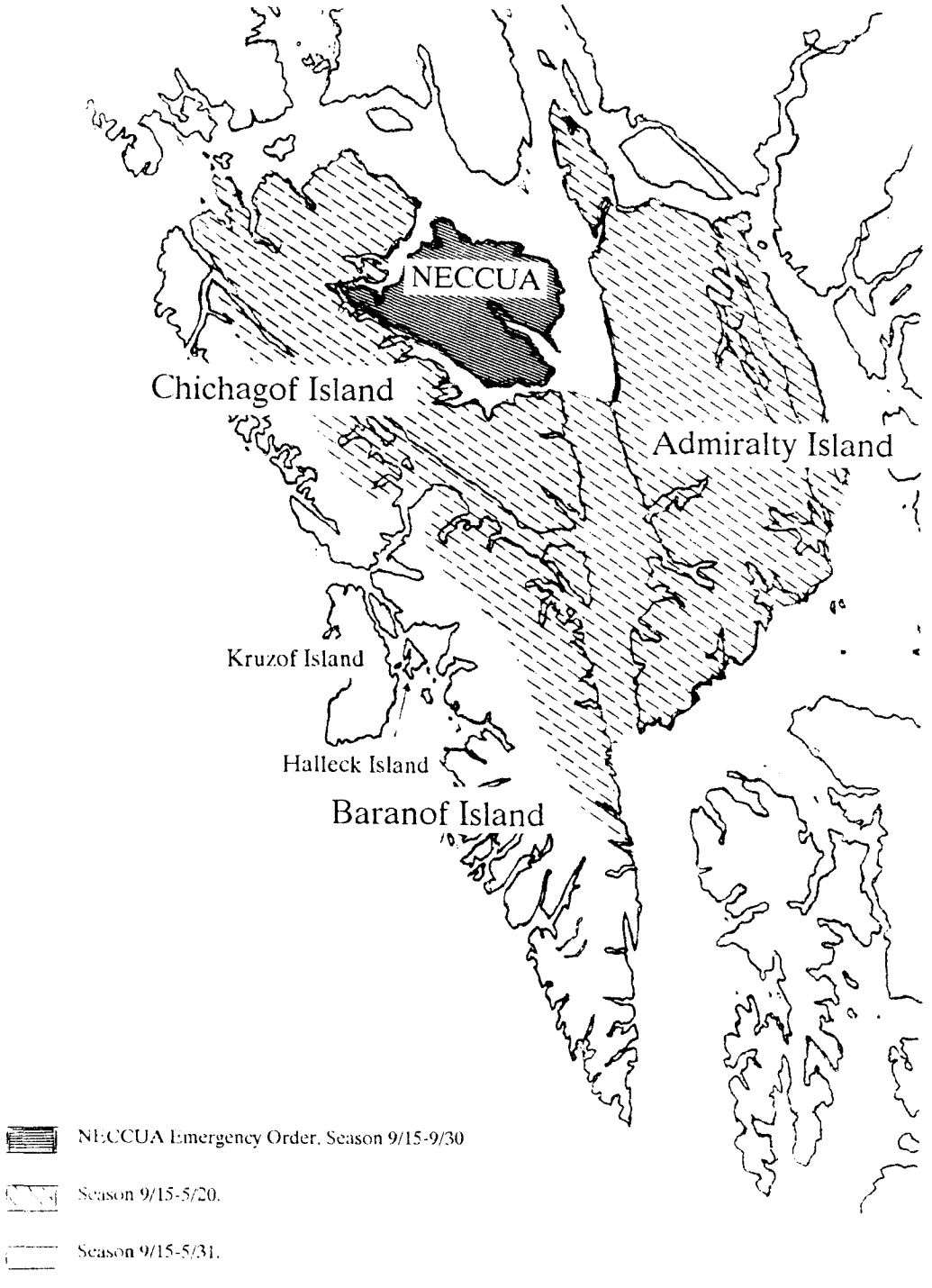

Figure 1. Unit 4 brown bear hunting seasons, 1988.

Table 1. Total Unit 4 brown bear harvest, 1984-1988.

	Male				Female				Sex unknown				
Year	Spring	Fall	Total	% total	Spring	Fall	Total	% total	Spring	Fall	Total	% total	Overall total
1984	62	11	73	66	11	17	28	25	3	7	10	9	111
1985	35	19	54	61	10	24	34	39	0	0	0	0	88
1986	46	17	63	66	17	13	30	31	2	1	3	3	96
1987	66	22	88	76	9	16	25	21	2	1	3	3	116
1988	58	25	83	71	8	18	26	22	6	2	8	7	117

Table 2. Average skull totals and ages of harvested Unit 4 brown bears, 1984-1988.

	Skull total						Age					
	Male		Female		Sex unknown		Male		Female		Sex unknown	
Year	Average	(N)	Average	(N)	Average	(N)	Average	(N)	Average	(N)	Average	(N)
1984	20.8	73	18.8	28	17.9	9	6.5	72	6.1	28	3.2	9
1985	20.8	50	19.1	31	0.0	0	6.5	54	7.5	32	0.0	0
1986	21.6	60	19.9	30	20.0	3	6.1	63	7.1	29	4.9	3
1987	22.8	85	20.0	25	19.4	3	8.2	85	6.9	23	3.9	3
1988	22.3	83	19.8	25	21.0	8	7.1	81	5.2	23	6.4	6

Table 3. Brown bear harvest by island and hunter residency in Unit 4, 1984 1988.

Year	Admiralty		Baranof		Chichagof		Halleck	Kruzof	% total		Total island harvest
	Res	Nonres	Res	Nonres	Res	Nonres	Res	Res	Res	Nonres	
1984	26	23	10	15	22	14	0	1	53	47	111
1985	8	18	9	13	20	20	0	0	42	58	88
1986	15	21	5	5	23	26	0	1	46	54	96
1987	22	24	12	13	27	17	0	1	53	47	116
1988	32	21	9	9	24	20	1	1	57	43	117

Table 4. Total and average days hunted by residency of brown bear hunter, 1984-1988.

Year	Resident		Nonresident		Resident and nonresident	
	Total	Average	Total	Average	Total	Average
1984	241	4.1	256	4.9	497	4.5
1985	121	3.3	257	5.0	378	4.3
1986	156	3.5	266	5.1	422	4.4
1987	206	3.3	261	4.8	467	4.0
1988	234	3.5	262	5.2	496	4.2

Table 5. Harvest by week and hunter residency, 1984-1988.

Time Period	1984			1985			1986			1987			1988		
	R[a]	N[b]	T[c]	R	N	T	R	N	T	R	N	T	R	N	T
Spring:															
04/11-04/20	3	2	5	0	0	0	0	0	0	0	0	0	0	0	0
04/21-04/30	5	2	7	0	0	0	0	2	2	3	2	5	0	0	0
05/01-05/10	17	17	34	5	7	12	13	13	26	13	10	23	12	8	20
05/11-05/20	12	8	20	8	18	26	14	13	27	23	18	41	29	16	45
05/21-05/31	3	7	10	1	6	7	2	8	10	0	8	8	0	7	7
Fall:															
09/11-09/20	4	9	13	7	10	17	3	10	13	1	7	8	7	12	19
09/21-09/30	6	5	11	8	9	17	0	6	6	3	9	12	7	7	14
10/01-10/10	0	2	2	1	1	2	2	0	2	5	0	5	5	0	5
10/11-10/20	4	0	4	3	0	3	5	0	5	6	0	6	0	0	0
10/21-10/30	3	0	3	2	0	2	2	0	2	5	0	5	5	0	5
11/01-11/10	0	0	0	1	0	1	1	0	1	3	0	3	1	0	1
11/11-11/20	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0
11/21-11/31	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0
12/01-12/10	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
12/11-12/20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12/21-12/31	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Totals	59	52	111	37	51	88	44	52	96	62	54	116	67	50	117

[a] Resident hunter.
[b] Nonresident hunter.
[c] Total hunters.

Table 6. Transportation means used by successful brown bear hunters, 1984-1988.

Transportation means	1984	1985	1986	1987	1988
Airplane	15	5	7	13	12
Boat	94	78	81	84	92
Vehicle (logging roads)	2	4	6	13	5
Walked (logging roads)	0	0	1	1	0
Vehicle (existing highways)	0	0	0	1	0
Access questionable	0	1	1	2	4
No information given/other	0	0	0	0	4
Total	111	88	96	114	117

HUNTING-TRAPPING
Emergency Order

ALASKA DEPARTMENT OF FISH AND GAME

Under Authority of AS 16.05.060

EMERGENCY ORDER No. 1-01-88

Issued at Juneau, Alaska
September 28, 1988

Effective Date: 11:59 pm
September 30, 1988

Expires December 31,1988 unless superseded by subsequent emergency order or Game Board action

EXPLANATION:

This emergency order closes a portion of Game Management Unit 4 on Northeast Chichagof Island to brown bear hunting for the remainder of the fall season. This action is required because of an apparent overharvest of bears.

REGULATION:

Therefore, 5 AAC 78.020 (3) SUBSISTENCE HUNTING SEASONS AND BAG LIMITS FOR BROWN AND GRIZZLY BEAR and 5 AAC 78.120 (3) GENERAL HUNTING SEASONS AND BAG LIMITS FOR BROWN AND GRIZZLY BEAR are amended to read:

UNIT	OPEN SEASON	BAG LIMIT
Unit 4, that portion on Chichagof Island north of Tenakee Inlet and east of Port Frederick	No open season	
Remainder of Unit 4	Sept. 15-May 20	One bear every 4 regulatory years

Don W. Collinsworth
Commissioner

by delegation to: _____
David A. Anderson
Regional Supervisor

JUSTIFICATION

Harvest, defense of life or property (DLP) and other taking of brown bears have increased to beyond sustainable limits in the last 2 years on northeast Chichagof Island. Since 1980, annual bear kills in this area have increased from an average of approximately 7 bears per year to an all time high of 21 bears in 1987. In calendar year 1988, 14 bears are known to have been killed, and an additional harvest of 5 to 8 is projected without this emergency order. The projected total kill of 19 to 22 bears is well beyond the sustainable yield of this population.

DISTRIBUTION

The distribution of this emergency order is to the listing below. Copies are available from Department of Fish and Game offices in Juneau and Sitka.

Lieutenant Governor
Attorney General
Commissioner, Department of Fish and Game
Director, Division of Game
Alaska Board of Game
Department of Public Safety, Fish and Wildlife Protection, Anchorage, Juneau, Hoonah
Magistrate, Hoonah
Forest Supervisor, Chatham Area, Tongass National Forest
Southeast Alaska News Media
United States Department of Interior, Fish and Wildlife Service and Bureau of Land Management

STUDY AREA

GAME MANAGEMENT UNIT: 5 (6,235 mi2)

GEOGRAPHICAL DESCRIPTION: Cape Fairweather to Icy Bay, eastern Gulf Coast

BACKGROUND

Since 1961 when brown bears were first sealed in Alaska, 566 sport-killed bears have been sealed from Unit 5. Most (63%) of these bears were males, and 56% were taken by nonresident hunters. An additional 49 bears have been reported taken outside of seasons during this same period.

The number of guided brown bear hunters has been fairly consistent throughout the years. Since about 1979 this interest has been stable, judging by the nonresident harvest percentages and the number of contracts filed by registered guides with the Department of Commerce and Economic Development; however, a recent Superior Court decision deregulating the guiding industry may encourage an increase in guiding activity in this unit.

POPULATION OBJECTIVES

To maintain 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.

METHODS

Most data were gathered from the sealing of brown bear hides by ADF&G and Fish and Wildlife Protection staff. During the sealing process, the skull is measured and a rudimentary premolar tooth is extracted for age determination. Additional information is obtained from the hunter, such as location of harvest, transportation method, number of days hunted, and guide information. Other information includes incidental observations of bear dens that were noted during aerial mountain goat surveys and anecdotal information from hunters.

RESULTS AND DISCUSSION

Population Status and Trend

Precise population information is not available for brown bears in Unit 5. Although data gathered from sealing certificates, incidental observations, and hunter interviews suggest that the population is stable, the male skull size and mean age of bears harvested during this reporting period are the smallest since 1981 and 1980, respectively.

Mortality

Season and Bag Limit:

The hunting season in Unit 5 is from 1 September to 31 May for subsistence, resident, and nonresident hunters. The bag limit is 1 bear every 4 regulatory years.

Human-induced Mortality:

Brown bear harvests have increased over the last 2 decades. The average annual harvest from 1971 to 1980 was 21 bears (range = 13-28), while the 1981-88 mean harvest was 33 bears (rang = 30-37). The mean age for male bears in the harvest has increased as well; ages during the 1971-80 period averaged 5.8 years, while the 1981-88 average was 6.5 years. Mean skull dimensions for males also increased; the average measurements were 20.1 and 22.3 for the 1971-80 and 1981-88 periods, respectively.

Sixteen males and 15 females were reported killed in 1988; 29 were harvested by hunters. One bear was killed by Public Safety personnel, and 1 bear was found dead at the city landfill. The last time the female portion of the total harvest neared 50% was 1969.

Hunter Residency and Success. The number and proportion of brown bears taken by nonresident hunters from 1984 to 1988 has been very consistent. Hunters have taken from 19 to 23 bears (mean = 21), representing 66-77% of the annual harvest (mean = 70%).

Harvest Chronology. The ratio of spring to fall harvest of brown bears has remained about the same since 1984. Before 1984, spring bears composed 56% of the annual take, but from 1984 to 1988, the average was 35%. This appears to be correlated to the increased total take since 1980, most of which has occurred during the fall season.

Transport Methods. Hunters used transportation types in 1988 similar to those observed in previous years; however, fewer aircraft were used for access to hunting areas than in previous years, while boats, highway vehicles, and off-road vehicles were used by the remainder. The use of off-road vehicles by bear hunters appears to be increasing in Subunit 5A.

CONCLUSIONS AND RECOMMENDATIONS

Management objectives for brown bears were not met in 1988. The mean age of male bears was only 5.1 years (compared with the 6.5-year population objectives), and the male:female harvest ratio was only 2.2:2 (versus 3:2). This is the second time since 1984 that the mean male age has fallen below 6.5 years but only the

2nd time in almost 2 decades that the portion of females in the harvest has been so high. The implications of increased fall harvests and the potential for increased guiding activity because of deregulation of the guiding industry suggest a more conservative approach to brown bear management may be needed in Unit 5.

The number of guided bear hunts increased beginning in 1984 (Table 2), and this may partially explain the higher fall harvest since that time. Increased fall harvests have reduced bear numbers in high density areas. If age and skull size continue to decline or if the male:female harvest ratio continues below 3:2, it may be necessary to reduce harvests in the near future.

Both black and brown bears are viewed as pests, rather than as valuable resources, by residents of Yakutat. The Yakutat dump has attracted bears for many years, and their Alaska Department of Environmental Conservation solid waste permit is currently under review. We should continue to emphasize to local residents the necessity of properly managing garbage.

PREPARED BY:

Bruce Dinneford
Wildlife Biologist III

SUBMITTED BY:

David M. Johnson
Regional Management Coordinator

Table 1. Brown bear harvests, ages, and skull sizes in Unit 5 .

	Harvest				Mean age				Mean skull size				Avg. days/harvest		
Year	MM	FF	Unk	Total	MM	FF	Unk	Total	MM	FF	Unk	Total	MM	FF	Unk
1984	25	10	1	36	7.5	5.1	4.4	6.7	22.8	19.9	22.9	22.0	5.0	5.0	-
1985	17	12	1	30	5.8	7.4	10.8	6.6	22.2	21.3	22.3	21.8	5.0	4.0	1
1986	20	10	0	30	7.6	5.6	-	6.9	23.4	20.1	-	22.4	4.0	7.0	-
1987	23	14	0	37	7.0	6.8	-	6.3	22.8	20.9	-	22.0	4.4	4.8	-
1988	16	15	0	31	5.1	4.2	-	4.7	21.3	20.8	-	21.1	3.6	3.5	-
Mean	20.2	12.2	0.4	32.8	6.6	5.8	7.6	6.2	22.5	20.6	22.6	21.9	4.4	24.3	1.0

Table 2. Guided brown bear hunts in Unit 5, 1978-1988[a].

Year	Number of hunts per guide						
	Guide 1	Guide 2	Guide 3	Guide 4	Guide 5	Guide 6	Total
1978	3	0	6	4	11	4	28
1979	4	15	3	6	2	2	32
1980	2	8	3	12	11	7	43
1981	4	11	55	5	15	2	42
1982	1	10	4	3	8	0	26
1983	3	5	8	7	11	5	39
1984	4	12	14	4	19	7	60
1985	2	11	9	3	11	7	43
1986	0	13	4	3	22	5	47
1987	0	15	10	5	19	3	52
1988	1	13	9	5	9	9	46
Total	24	113	125	57	138	51	458
Average	2.2	10.3	11.4	5.2	12.6	4.6	41.6

[a] Data from Department of Commerce and Economic Development.

STUDY AREA

GAME MANAGEMENT UNIT: 6 (14,300 mi^2)

GEOGRAPHICAL DESCRIPTION: Prince William Sound and north Gulf Coast

BACKGROUND

Brown bears are endemic to most of Unit 6, with the exception of Middleton Island and the islands west of Montague Island and Valdez Arm. They are rare or absent on the mainland in Subunit 6D west of Columbia Glacier. Brown bear distribution in Subunit 6D has apparently changed little from that observed in 1908 by Heller (1910).

The total reported mean annual harvest of brown bears in Unit 6 between 1961 and 1987 can be characterized as follows: (1) annual harvest was 35; (2) bears reported killed illegally or in defense of life or property represented 3% of the annual harvest; (3) sex composition of sport-killed bears was 59% males, 37% females, and 4% unknown; (4) 56% of the sport harvest occurred during the spring; (5) 48% of all bears came from Subunit 6D, 26% from Subunit 6A, 15% from Subunit 6B, and 11% from Subunit 6C; (6) the mean annual skull size of sport-killed male bears was 23.4 inches; (7) nonresident hunters accounted for 42% of the sport harvest; and (8) 62% of successful hunters used airplanes for transportation to their hunt area, 22% used boats and 16% used some other form of transportation (ADF&G files).

The greatest future impact to brown bear abundance and distribution will be loss of habitat and encroachment by humans. Timber harvests will probably produce the single greatest destruction of brown bear habitat. Over the next 20 years, up to 10,000 acres of old-growth forest within brown bear habitat may be clear-cut. Extraction of coal from the Bering River drainage may occur in the near future, and the development associated with mining will reduce habitat and increase harvest pressures. Increased recreational activities and growing remote settlements will also encroach on bear habitat and increase the legal and illegal harvests.

POPULATION OBJECTIVES

To maintain a brown bear population that will sustain an annual harvest of 35 bears composed of at least 60% males with a minimum average skull size of 23.0 inches.

METHODS

The hide and skull of all brown bears killed in Unit 6 are required to be sealed by a Department official. Each hide was checked for sex identifiers, skulls were measured, and a rudimentary premolar tooth was pulled for age assessment. Hunters were asked to report on date of harvest, number of days hunted, location of harvest, and type of transportation used to access hunting area.

On 20 April a Cessna-180 aircraft was used to identify denning locations and evidence of den emergence on Hinchinbrook and Montague Islands. Elevations between 1,000 and 2,000 feet were surveyed. Dens and tracks of bears were noted on 1:250,000-scale USGS maps. The survey provided crude comparisons of relative densities between the 2 islands. The brown bear harvests from 1961 to 1988 were compared for 3 areas: Montague Island; Subunit 6D, except Montague Island; and Unit 6, except Subunit 6D.

RESULTS AND DISCUSSION

Population Status and Trend

Sealing data suggest a decreased availability of brown bears on Montague Island; the mean annual harvests there during the 1960's were 7.7, 4.5, and 3.7 brown bears for 1961-69, 1970-79, and 1980-88, respectively. The mean annual harvests by respective decades for the remainder of Subunit 6D were 11.5, 9.8, and 15.2. The mean annual harvests by respective decades for Unit 6, excluding Subunit 6D, were 16.5, 16.7, and 23.2. On adjacent Hinchinbrook Island the mean annual harvests by decade were 5.3, 4.0 and 5.7 bears, respectively. The greater mean annual harvests during the 1980's for most of Unit 6 reflects increased effort by sport hunters as well as increased bear populations. Montague Island failed to exhibit increased harvest levels during the 1980's, despite increased effort. The brown bear population in the remainder of Unit 6 is at a high level.

Population Size:

Brown bear densities within the major drainages in Unit 6 were between 0.05 and 0.50 bears/mi^2, compared with 1.02 bears/mi^2 for Admiralty Island in Unit 4 (Schoen and Beier 1988), 0.03 bears/mi^2 for a heavily hunted portion of the Upper Susitna River in Unit 13 (Miller 1988), and 0.56 bears/mi^2 for Kodiak Island (Barnes et al. 1988). An estimate of densities on the west Copper River Delta ranged between 0.22 and 0.30 bears/mi^2 between 1984 and 1986 (Campbell and Griese 1987).

The April den and track survey indicated a smaller density of bears on Montague Island than on Hinchinbrook Island. During a 100-mile survey of Hinchinbrook Island, 1 den and 9 sets of tracks were observed; in 165-mile survey of Montague Island, 3

dens and 3 sets of tracks were observed. Montague Island had roughly 30-50% of the density of bears that were present on Hinchinbrook Island; however, single bears may have been responsible for more than 1 set of tracks.

The density for brown bears on Hinchinbrook Island is approximately 0.2-0.4 bears/mi^2, which is at the higher end of previously estimated levels for all of Unit 6. There may be 33 to 66 bears on Hinchinbrook Island (165 mi^2). Based on the relative differences in densities indicated by the den and track survey, densities on Montague Island may range from 0.06-0.20 bears/mi^2. Montague Island (310 mi^2) had an estimated total of 19 to 62 bears.

Mortality

Season and Bag Limit:

The open season for residents and nonresident hunters in Unit 6 is 1 September to 31 May. The bag limit is 1 bear per 4 regulatory years; the haresting of cubs and females accompanied by cubs may is prohibited.

Human-induced Mortality:

Sealing records indicate 72 brown bears were killed in 1988 (Table 1): 65 sport-killed bears, 4 illegally killed bears, and 3 bears killed in defense of life or property. The nonsport mortality represented 10% of the total annual harvest, which is higher than the historical average of 3%.

The number of bears sealed in 1988 represents the highest annual harvest recorded in Unit 6: 105% above the 1961-1987 annual mean of 35. A record sport harvest occurred on Hinchinbrook Island in Subunit 6D, where 15 bears were taken (Table 1). The previous 26-year average of bears killed on Hinchinbrook Island was 4.6. Record sport harvest levels were equalled in Subunit 6A west of Cape Suckling and in mainland Subunit 6D east of Valdez Arm (Rude River-Ellamar).

Distribution of sport-killed bears in 1988 differed little from the historical distribution; 52% came from Subunit 6D and the remainder from Subunit 6A (26%), Subunit 6B (12%), and Subunit 6C (9%) (Table 1). The nonsport mortality (7 bears) is the highest in 5 years, indicating an increasing trend.

The 1988 harvest was composed of 35 (49%) males, 34 (47%) females and 3 (4%) unknowns. There were 35 (54%) males, 29 (45%) females, and 1 (1%) unknown in the sport harvest. The composition of the 7 nonsport bears killed was 5 (71%) females and 2 (29%) of unknown sex.

The mean skull sizes and ages of sport-killed bears in Unit 6 have varied little since 1984 (Table 2). Mean skull size of male

bears in 1988 was 23.4 inches; the mean skull size of female bears was 20.5 inches. Correspondingly, the mean age for females killed in 1988 was 5.7 years. Both measurements suggested an increase in subadult females in the harvest.

Successful hunters in 1988 continued the increased trend of using boats to access their hunting areas (Table 3). In 1988, 35% of successful bear hunters used boats, 51% used airplanes, and 14% used other types of transportation. The historical mean percentages for Unit 6 transportation methods were 22% and 62% for boats and airplanes, respectively. The accessibility of Subunit 6D by boat and the corresponding increase in the harvest in Subunit 6D explains the trend.

Hunter Residency and Success. In 1988 nonresident hunters took 34 bears, representing 52% of the total sport harvest (Table 4). A substantial increase in harvest by nonresidents in Subunit 6D suggests increased effort by commercial guide/outfitters. Resident hunters killed the greatest percentage of their bears in Subunit 6D between 1984 and 1988 (Table 4).

Harvest Chronology. Sport hunters killed 35 (55%) bears during the spring and 29 (45%) during the fall. Since 1984, 19% of the sport harvest occurred during the last 2 weeks of May, followed by the latter half of September (17%), the first half of May (16%), and the first half of September (15%).

Since 1984 the month of May and the first 2 weeks of October have produced greater than 40% females in the harvest. Subunit 6D produced greater than 40% females for each spring period, averaging 46% for the spring season. Only Subunit 6A produced less than the average 40% females during the fall season.

Game Board Actions and Emergency Orders

No changes have been made to the season since the Board of Game lengthened the spring season by 6 days for the 1987-1988 regulatory year (Griese 1989). The bag limit has remained unchanged since 1968, when the Board reduced the bag limit from 1 bear per regulatory year to 1 bear every 4 regulatory years.

CONCLUSIONS AND RECOMMENDATIONS

The harvest of 72 bears far exceeded the unit's objective (i.e., 35 bears). Although the mean skull size of male bears exceeded the harvest objective of 23.0 inches, the composition of the total harvest failed to meet the objective (i.e., 60% males). The high percentage of females (71%) in the nonsport harvest compounded that failure. The high harvest may have compromised future sustained harvest levels on Montague and Middleton Islands as well as the western portion of Subunit 6A.

Attaining population objectives in the future will depend on our ability to educate hunters on how to select for adult male bears, establish season dates that optimize the selection of male bears, regulate hunting effort by commercially guided hunters, and maintain ample protection from human encroachment and habitat destruction.

I recommend we assess relative bear densities and trends on Montague Island. Impending timber sales by private and federal land managers will remove significant quantities of forest habitat on the southern half of the island, facilitating improved access for a greater number of hunters. We need to anticipate bear hunter demands and modify regulations to maintain a desired bear density under these changing conditions.

Based on population estimates for Montague Island and sustainable harvest levels recommended by Miller (1988), the brown bear population on Montague Island has experienced excessive harvesting. Miller (1988) calculated sustainable harvest levels for the brown bear population in Unit 13 to be 6-8%, given their reproductive potential. If population similarities are assumed, applying those harvest levels to the estimated 19-62 bears on Montague produces a maximum acceptable harvest range between 1 and 5 bears, annually. To prevent the female segment from exceeding 40% of the maximum acceptable harvest, no more than 2 females should be killed in any year. In the last 5 years the average harvest on Montague Island has been 5.0 bears composed of 2.6 females, 1.8 males and 0.1 unknowns.

I recommend reduced season lengths for Montague Island to curtail the current harvest levels and allow recovery of the brown bear population. Excessive brown bear harvest levels reported since the 1970's have been primarily responsible for indicated density reductions. In order to reverse declining trends on Montague Island, harvest levels should be reduced below sustainable levels and the opportunity to harvest females should be minimized. Hunting seasons for Montague Island should be from 1 April to 15 May. Eliminating the fall and late May season should accomplish a 70-80% reduction in sport harvest and minimize the harvest of females.

Timber harvest activities that will begin on Montague Island in 1990 necessitate reduced bear hunting opportunities, given population status and trends. If season lengths were to remain unchanged, sport hunting effort would increase to unacceptable levels. An increase is anticipated because of improved access and human presence afforded by logging developments. Nonsport harvests also will likely increase as timber-related activities begin on the south end of the island. In the past, deer hunters were primarily responsible for the nonsport harvest of brown bears. Reduced bear hunting seasons may also increase nonsport harvest by deer hunters.

The increased trend for nonresident hunters to take brown bears in Subunit 6D was the function of changes in commercial guiding patterns. Establishment of new regulations for commercial guide/outfitters may offer the necessary controls to prevent future problems of excessive harvests. In lieu of necessary commercial regulations, reduced season lengths for all hunters should be established. To reduce harvest by 30-50%, the recommended season dates are 1 April to 25 May and 16 October to 30 November.

I further recommend that research efforts be directed at assessing the impacts of clear-cutting large tracts of the limited timber stands in Unit 6. Until such an assessment is completed, anticipating impacts of timber harvest practices on brown bear populations will have to be drawn from results of studies conducted in Southeast Alaska by Schoen and Beier (1987). Differences in habitat distribution and quantity between Southeast Alaska and Unit 6 may, however, cause significantly different impacts.

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SUBMITTED BY:

John N. Trent
Management Coordinator

Figure 1. Mean annual brown bear kill by decade for Montague Island, Subunit 6D less Montague Island, and Unit (GMU) 6 less Subunit 6D, Alaska, 1961-1988.

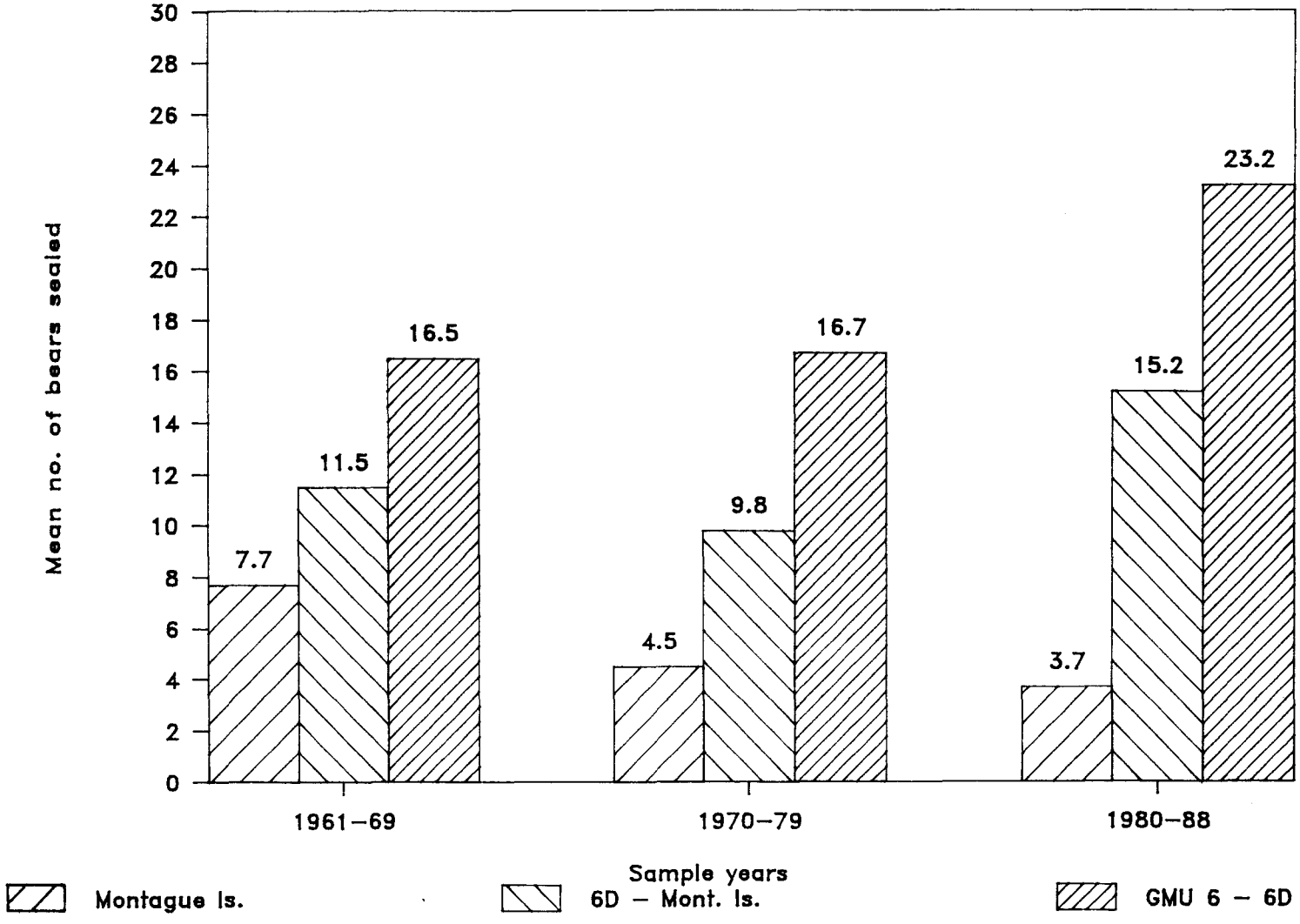

Table 1. Annual sport and nonsport brown bear harvest by subunit and hunt area subdivision in Unit 6, 1984-88.

	1984			1985			1986			1987			1988			Total		
	Sport		Non-sport	Sport		Non-sport	Sport		Non-sport	Sport		Non-sport	Sport		Non-sport	Sport		Non-sport
Subunit	No.	%	No.	No.	%	No.	No.	%	No.	No.	%	No.	No.	%	No.	No.	%	No.
6A																		
Icy Bay	6	17	0	11	28	0	4	8	2	7	14	0	6	9	0	34	14	2
Cape Suckling	6	17	0	8	20	1	6	12	0	9[a]	18	0	9[a]	13	0	38	15	1
Katalla	0	0	0	2[a]	5	0	0	0	0	1	2	0	2[a]	3	0	5	2	0
Kayak Is.	12	34	0	21[b]	53	1	10	20	2	17	34	0	17	26	0	77	32	3
Subtotal																		
6B Subtotal	4	11	0	3	7	0	11[b]	22	0	7	14	0	8	12	1	33	13	1
6C Subtotal	5	14	2	1	2	1	4	8	1	4	8	0	6	9	1	20	8	5
6D																		
Rude River-Ellamar	6	17	0	8	21	0	6	12	1	13[a]	27	2	13[a]	20	1	46	19	4
Valdez Arm	2	6	2	0	0	0	2	4	0	2	4	3	2	3	0	8	3	5
Montague Is.	3	9	0	3	8	0	11	22	1	0	0	0	4	6	3	21	9	4
Hinchinbrook Island	3	9	0	3	8	1	6	12	0	6	12	1	15[b]	23	1	33	14	3
Hawkins Is	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Western PWS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal	14	40	2	14	35	1	25	50	2	21	42	6	34[b]	52	5	108	45	16
Unit 6 Total	35	100	4	39	100	3	50	100	5	49	100	6	65[b]	100	7	238	100	25

[a] Equals highest sport harvest on record for area.

[b] Highest sport harvest on record for area.

Table 2. Average skull sizes (inches) and ages of sport killed brown bears in Unit 6, 1984-1988.

	Skull sizes[a]				Ages					
	Males		Females		Males		Females		Sex unknown	
Year	Average	(n)	Average	(n)	Average	(n)	Average	(n)	Average	(n)
1984	23.4	(23)	21.6	(10)	6.9	(23)	8.4	(9)	4.6	(2)
1985	22.5	(26)	20.4	(12)	6.4	(27)	6.3	(12)	0.0	(0)
1986	23.8	(21)	21.6	(22)	8.3	(22)	7.8	(23)	4.5	(3)
1987	23.2	(31)	21.4	(16)	6.5	(31)	9.3	(17)	7.8	(1)
1988	23.4	(37)	20.5	(27)	6.6	(35)	5.7	(27)	4.8	(1)
Annual Mean	23.2		21.1		6.9		7.3		5.0	

[a] Skull size equals total length plus zygomatic width.

Table 3. Successful brown bear hunter transport methods in Unit 6, 1984-1988.

Year	Airplane	%	ORV	%	Boat	%	Other	%	Unknown	%	Total	%
1984	20	57	1	3	6	17	7	20	1	3	35	100
1985	26	67	1	3	6	15	6	15	0	0	39	100
1986	29	58	1	2	14	28	6	12	0	0	50	100
1987	25	51	1	2	17	35	6	12	0	0	49	100
1988	33	51	5	8	23	35	3	5	1	2	65	100
Total	133	56	9	4	66	28	28	12	2	1	238	100

Table 4. Successful brown bear sport hunter residency by subunit in Unit 6, 1984-1988.

Subunit	Year	Residents			Nonresidents			Total	%	Unit %[a]
		No.	%	Unit %[a]	No.	%	Unit %[a]			
6A	1984	4	33	11	8	66	22	12	100	34
	1985	11	52	28	10	47	25	21	100	53
	1986	5	50	10	5	50	10	10	100	20
	1987	3	17	6	14	82	28	17	100	34
	1988	4	23	6	13	76	20	17	100	26
	Total	27	35	11	50	64	21	77	100	32
	Mean	5.4			10.0			15.4		
6B	1984	2	50	5	2	50	5	4	100	11
	1985	3	100	7	0	0	0	3	100	7
	1986	4	36	8	7	63	14	11	100	22
	1987	3	42	6	4	57	8	7	100	14
	1988	5	62	7	3	37	4	8	100	12
	Total	17	51	7	16	48	6	33	100	13
	Mean	3.4			3.2			6.6		
6C	1984	5	100	14	0	0	0	5	100	14
	1985	1	100	2	0	0	0	1	100	2
	1986	4	100	8	0	0	0	4	100	8
	1987	4	100	8	0	0	0	4	100	8
	1988	5	83	7	1	16	1	6	100	9
	Total	19	95	7	1	5	<1	20	100	8
	Mean	3.8			0.2			4.0		
6D	1984	8	57	22	6	42	17	14	100	40
	1985	12	85	30	2	14	5	14	100	35
	1986	17	68	34	8	32	16	25	100	50
	1987	13	61	26	8	38	16	21	100	42
	1988	17	50	26	17	50	26	34	100	52
	Total	67	62	28	41	37	17	108	100	45
	Mean	13.4			8.2			21.6		
Total Unit 6	1984	19	54		16	46		35	100	
	1985	27	69		12	31		39	100	
	1986	30	60		20	40		50	100	
	1987	23	46		26	53		49	100	
	1988	31	47		34	52		65	100	
	Total	130	54		108	45		238	100	
	Mean	26.0			21.6			47.6		

[a] % of annual Unit 6 total.

STUDY AREA

GAME MANAGEMENT UNITS: 7 and 15 (10,038 mi^2)

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

BACKGROUND

Brown bears are found throughout the remote lowland forests and intermountain valleys of the Kenai Peninsula. Most historical brown bear range remains occupied; however, bears have been displaced from some regionally important habitats such as the lower portions of many salmon spawning rivers along Cook Inlet's east shore. Field observations from many different sources and analyses of harvest data indicate that brown bear populations are most abundant in the forested lowlands lying west of the Kenai Mountains and south of Skilak Lake and the Russian River drainage. Adult salmon from the numerous spawning streams in this region provide bears with a protein-rich summer diet.

Little is known about the population dynamics and habitat ecology of brown bears on the Kenai Peninsula; although, some inferences about their ecology can be drawn from research conducted in other regions of Alaska and Canada. In 1984 representatives of the U.S. Fish and Wildlife Service, U.S. Forest Service, and the Alaska Department of Fish and Game formed the Interagency Brown Bear Study Team (IBBST) to discuss brown bear management and research needs on the Kenai Peninsula and to coordinate joint studies. The IBBST has conducted baseline inventories of salmon spawning streams and high use brown bear areas (Bevins et al. 1984, Risdahl et al. 1986); most recently, it completed the initial draft of an interagency brown bear management plan for the Kenai Peninsula (Jacobs 1989).

POPULATION OBJECTIVES

To maintain a population of 250 brown bears with a sex and age structure that will sustain a harvest composed of at least 60% males.

METHODS

No practical survey techniques exist to accurately determine the size of brown bear populations over large forested areas. Consequently, estimates of brown bear abundance in the Kenai Peninsula are based on known distributions, impressions of relative local abundance, and estimates of densities in other parts of Alaska. A point estimate of population size is derived from a density of 1 bear/15 mi^2 and 3,750 mi^2 of suitable range.

A mandatory sealing program has provided information concerning the distribution, magnitude, and sex-age composition of brown bear harvests in Alaska since 1961. Sex ratios of bear harvests supplement the Department's assessment of brown bear population status.

RESULTS AND DISCUSSION

Population Size

The Kenai Peninsula brown bear population is estimated at about 250 bears.

Mortality

Season and Bag Limit:

The open seasons in Unit 7 and 15 for resident and nonresident hunters are 10 to 25 May and 1 September to 15 October. The bag limit is 1 bear every 4 regulatory years. The harvesting of cubs and females accompanied by cubs is prohibited.

Human-induced Mortality:

In 1988 the total reported harvest was 14 brown bears, including 13 sport-harvested bears (Table 1). Sex composition of the sport harvest was 6 males and 7 females. Mean ages of males and females were 6.5 (n = 4, range = 2.8-16.4 yrs) and 4.0 years (n = 7, range = 2.4-7.8 yrs), respectively. Nine (82%) of the sport-killed bears for which age had been estimated were 4.8 years or younger. In the sport harvest 4 and 9 fall bears were killed in the spring and fall, respectively. The nonsport harvest was one 2.8-year-old female taken under the state's defense of life or property (DLP) code. She was killed in the South Fork/Anchor River drainage (Subunit 15C) in September. A review of historical brown bear harvest data was previously made by Holdermann (1989).

Hunter Residency. Residents killed 9 bears (i.e., 70%), and nonresidents killed 4 bears (i.e., 30%).

Game Board Actions and Emergency Orders

The Board of Game adopted a Department proposal to change the opening date of the fall brown bear season from 1 September to 15 September with the same 15 October closing date. Concern for this change arose from the high proportion of females in the total harvest (52% since 1980), the steady increase in annual sport harvests, and uncertainties about the population status of Kenai Peninsula brown bears (Holdermann 1987). Analysis of historical harvest chronologies strongly suggested that reduction of the overlapping fall moose and brown bear hunting seasons offered the

most effective means of lowering the proportion of females in the harvest.

CONCLUSIONS AND RECOMMENDATIONS

A 15 September opening date for the fall brown bear season will reduce the overlapping with the fall moose season on the Kenai Peninsula from 20 days to 5 days. This change should focus hunting pressure on older, "larger-bodied" male bears, thereby reducing the proportion of females as well as the overall number of brown bears harvested by sport hunters. The effects of the new season dates on the sex and age ratios of brown bear harvests will be carefully monitored, especially with respect to the management objective of sustaining at least 60% males in the harvest. Special attention should be given to evaluating the reported and unreported harvest from 1 to 14 September, when large numbers of moose hunters will be afield.

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Table 1. Summary of Kenai Peninsula brown bear sport harvests by unit, 1980-88.

Year	Unit 7			Unit 15			Total
	Males	Females	Unknown	Males	Females	Unknown	
1980	-	3	1	5	6	-	15
1981	1	2	-	4	6	-	13
1982	1	1		5	1	-	8
1983	-	1	-	3	3	-	7
1984	-	2	-	3	3	1	9
1985	2	-	1	7	4	-	14
1986	-	-	-	4	10	1	15
1987	2	-	-	6	4	-	12
1988	1	-	-	5	7	-	13
Totals	7	9	2	42	44	2	106

STUDY AREA

GAME MANAGEMENT UNIT: 8 (8,750 mi^2)

GEOGRAPHICAL DESCRIPTION: Kodiak and adjacent islands

BACKGROUND

Brown bears occur on Kodiak, Afognak, and most other nearby islands. The Kodiak National Wildlife Refuge, which includes approximately 60% of the area occupied by bears in Unit 8, was created in 1941 by President Franklin D. Roosevelt to preserve brown bear habitat. Most of the brown bear habitat is relatively remote and undeveloped, except for a small area on northeastern Kodiak Island near the city of Kodiak. Several hundred thousand acres of land, including 310,000 acres from the Kodiak National Wildlife Refuge, were conveyed to Native village corporations under terms of the Alaska Native Land Claims Settlement Act of 1971. Development of private lands, growth of 5 remote villages, increasing recreational hunting and fishing, hydroelectric power development, logging, and an expanding human population are real or potential threats to brown bears in the immediate future.

Brown bear hunting opportunities in Unit 8 are in great demand by both Alaskan resident and by nonresident hunters. Excessive harvest in popular hunting areas in southwestern Kodiak Island in the mid-1960's prompted temporary closures in the Karluk River and nearby drainages. To reduce hunter densities and better distribute harvests, the U.S. Fish and Wildlife Service (USFWS) began a land-use permit system for brown bear hunting on the Kodiak National Wildlife Refuge in 1968. An increasing trend in harvest by the mid-1970's and increasing demand for the land-use permits resulted in the State's implementing a permit lottery for brown bear hunting in 1976, replacing the federal land-use permits. Annual sport harvests have ranged from 124 to 191 bears (mean = 156.0) from 1978 to 1988.

POPULATION OBJECTIVES

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

METHODS

Harvest data were collected from mandatory hunter reports and from the hide and skull sealing program. Hunting was monitored in the field by staff patrolling in boats and aircraft. Aerial sex and age composition surveys were conducted on selected salmon streams on southwestern Kodiak Island by U.S. Fish and Wildlife Service (USFWS) personnel. Recent brown bear research projects were noted in the previous year's report (Smith 1989). A study

of conflicts between Sitka black-tailed deer hunters and brown bears on the Kodiak National Wildlife Refuge was begun in 1988 by the USFWS. A cooperative study by the USFWS and the Alaska Department of Fish and Game on female reproductivity and survival of brown bears is scheduled for completion in 1992. That study, (begun in 1987) has been partly funded by the Kodiak Brown Bear Habitat and Maintenance Trust, which was established to mitigate the impacts of constructing the Terror Lake hydroelectric project on the Kodiak National Wildlife Refuge.

RESULTS AND DISCUSSION

Population Status and Trend

The brown bear population appears to be stable throughout Unit 8.

Population Size:

Brown bear population estimates were discussed during the previous reporting period (Smith 1989). A tentative estimate of 1,928 independent bears (excluding dependent cubs) was extrapolated from applying the bear-days estimator (Miller et al. 1987) in 2 study areas on Kodiak Island (Barnes et al. 1988).

Population Composition:

Aerial brown bear composition surveys were conducted from 21 July to 2 August (Table 1). Although composition was comparable to that recorded in previous years, below-average numbers of bears were found on surveyed streams. The high abundance of berries and uniformly good escapement of salmon into streams may have resulted in wider-than-usual distribution of bears (Victor G. Barnes, pers. commun.).

Mortality

Season and Bag Limits:

The open seasons for resident and nonresident hunters in Unit 8 are 25 October to 30 November (fall) and 1 April to 15 May (spring). The bag limit for that portion of Kodiak Island east of a line from the mouth of Saltery Creek to Crag Point and Spruce Island is 1 bear every 4 regulatory years by registration permit only. The bag limit for the remainder of Unit 8 is 1 bear every 4 regulatory years by registration permit only. Residents, as well as nonresidents accompanied by residents within the second degree of kindred, may take a bear by drawing permit only; nonresidents guided by a guide-outfitter may take bears by registration permit only.

Human-induced Mortality:

The brown bear harvest in 1988 was 175 bears: 110 males (64%) and 63 females (36%), representing the 3rd-highest annual harvest in the past 11 years (Table 2). The spring harvest was 121 bears: 80 males (67%), 40 females (33%), and 1 unknown. The fall harvest was 54 bears: 30 males (57%), 23 females (43%), and 1 unknown. Defense of life or property (DLP) and other mortalities totaled 16 bears. The total documented mortality in 1988 was 191 bears.

Trophy size remained high in 1988 with a 24.7-inch average skull size for males (Table 3). Mean ages of both males and females were within the range recorded for the previous 10 years (Table 3); however, the 1988 aging data is being reanalyzed because of an initial high rate of error in reading the tooth cementum lines. The female sport harvest in 1988 (i.e., 63 bears) was above the 1978-87 mean of 56.3 females.

Hunter Effort and Success. Permits were issued to 497 hunters in 1988; 405 hunters reported going afield, and hunter success was 43%. Hunter success was 48% for 347 hunters afield in hunt Nos. 201-229 (i.e., drawing permit) (Table 4). Hunter success was only 10% for the 58 hunters afield in registration hunt No. 260 (Table 5).

This was the first complete year since a regulatory change reduced the registration hunt area to a small portion of northeastern Kodiak Island and expanded the drawing hunt area to include Afognak, Raspberry, and Shuyak Islands and additional areas on Kodiak Island. A corresponding increase in the hunters afield in the drawing-permit hunt and a decline in hunters afield in the registration permit hunt were evident (Tables 4 and 5).

Habitat

Most of Unit 8 is relatively undeveloped, and brown bear habitat is largely intact. Increasing human use and occupancy of brown bear habitat in the future is expected to result in more bear-human conflicts. Efforts to alleviate bear-human conflicts include disseminating educational material and consulting with agencies on minimizing effects of development and preventing bear encounters.

Game Board Action and Emergency Orders

Recent regulatory changes were reviewed by Smith (1989). The present regulations were adopted for the 1987-88 regulatory year.

CONCLUSIONS AND RECOMMENDATIONS

The change from a registration permit hunt to a drawing-permit hunt was effective in reducing the harvest on Afognak Island.

Only 12 bears (7 males, 5 females) were killed there by sport hunters in 1988, compared to the previous 5-year mean annual harvest of 20.6 bears.

The current management objective (i.e., to maintain a population that can sustain an annual sport harvest of 150 bears with a minimum of 60% males) is being met. Emphasis will be placed on maintaining population diversity and providing large trophy bears for harvest in revised objectives currently being developed. The present level of human-induced mortality appears to be sustainable. Population estimates made in 1987 indicated that brown bear abundance compared closely with estimated abundance in the 1960's (Barnes et al. 1988). No change in current regulations is recommended.

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Table 1. Annual brown bear aerial stream composition counts in Unit 8, 1978-88.

Year	No. Complete surveys	Single Bears No.	Single Bears %	Maternal Bears No.	Maternal Bears %	Yearlings + No.	Yearlings + %	Cubs No.	Cubs %	Total
1978	3	63	44%	26	18%	33	23%	22	15%	144
1979	2	38	54%	12	17%	12	17%	9	13%	71
1980	3	134	65%	23	11%	41	20%	7	3%	205
1981	7	169	55%	41	13%	79	25%	21	7%	310
1982	7	430	48%	150	17%	207	23%	107	12%	894
1983	----------	----------	----------	----------	NO COUNTS	----------	----------	----------	----------	----------
1984	6	186	51%	56	15%	69	19%	56	15%	367
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	54%	58	15%	92	23%	31	8%	397
1988	4	117	51%	39	17%	50	22%	23	10%	229

Table 2. Annual brown bear sport harvest and defense of life or property and other mortalities in Unit 8, 1978-88.

	Sport Harvest								
Year	% Males	males	% Females	females	Unk. sex	Total	DLP[a] kill	Other mortality	Total mortality
1978	77	62%	47	38%	0	124	8	4	136
1979	83	60%	56	40%	0	139	4	4	147
1980	73	58%	53	42%	1	127	8	5	140
1981	98	66%	50	34%	0	148	6	3	157
1982	97	66%	51	34%	0	149	12	4	165
1983	96	62%	60	38%	0	156	5	5	166
1984	134	70%	57	30%	0	191	11	7	209
1985	123	66%	61	34%	2	187	14	10	211
1986	96	57%	73	43%	0	169	15	4	196
1987	96	64%	55	36%	0	151	11	12	174
1988	110	64%	63	36%	2	175	8	8	191

[a] Defense of life or property.

Table 3. Mean age and skull size of sport-harvested brown bears in Unit 8, 1978-88.

Year	Mean skull size (inches)				Mean age			
	Males		Females		Males		Female	
1978	23.7	(72)	21.4	(46)	6.3	(75)	6.9	(47)
1979	23.5	(79)	21.4	(54)	6.0	(83)	6.7	(54)
1980	23.9	(66)	21.3	(51)	6.1	(73)	6.7	(52)
1981	24.2	(91)	21.8	(48)	6.5	(97)	7.3	(48)
1982	24.2	(94)	21.8	(48)	6.5	(94)	7.8	(50)
1983	24.4	(85)	21.9	(57)	7.4	(94)	8.5	(60)
1984	24.8	(127)	21.7	(53)	7.5	(131)	8.1	(57)
1985	24.4	(120)	22.0	(56)	7.2	(120)	7.5	(60)
1986	24.6	(91)	22.1	(61)	7.1	(94)	8.4	(71)
1987	24.9	(91)	21.9	(50)	7.7	(94)	7.6	(53)
1988	24.7	(105)	21.7	(61)	7.0	(111)	6.2	(61)

Table 4. Hunter residency and success for brown bear drawing-permit hunt Nos. 201-229 in Unit 8, 1978-88

	Residents				Nonresidents				All hunters			
Year	No. permits available	No. hunters	No. successful	% success	No. permits available	No. hunters	No. successful	% success	No. permits available	No. hunters	No. successful	No. success
1978	198	128	45	35%	125	95	65	68%	323	223	110	49%
1979	198	136	38	28%	125	104	77	74%	323	240	115	48%
1980	198	113	38	34%	125	79	65	82%	323	192	103	54%
1981	198	123	46	37%	125	97	75	77%	323	220	121	55%
1982	198	129	41	32%	125	89	75	84%	323	218	116	53%
1983	198	124	47	38%	125	94	76	81%	323	218	123	56%
1984	198	139	66	47%	125	104	86	83%	323	243	149	61%
1985	198	140	61	44%	125	106	79	75%	323	246	140	57%
1986	198	132	44	33%	125	105	87	83%	323	237	131	55%
1987[a]	235	163	47	29%	134	120	86	72%	369	283	133	47%
1988	319	218	79	36%	153	129	89	69%	472	347	168	48%

[a] Hunt Nos. 227, 228 and 229, which were previously included in registration hunt No. 250, were added to the drawing hunts in fall 1987.

Table 5. Hunter residency and success for brown bear drawing permit hunts Nos. 260 in Unit 8, 1978-88.

	Residents				Nonresidents				All hunters			
Year	No. permits available	No. hunters	No. successful	% success	No. permits available	No. hunters	No. successful	% success	No. permits available	No. hunters	No. successful	No. success
1978	183	79	6	8%	19	14	5	36%	202	93	11	12%
1979	222	153	19	12%	16	14	4	29%	238	167	23	14%
1980	228	147	13	9%	19	17	9	53%	247	164	22	13%
1981	308	194	17	9%	24	22	8	36%	332	216	25	12%
1982	414	212	25	12%	14	12	4	33%	428	224	29	13%
1983	486	268	27	10%	20	15	4	27%	506	283	31	11%
1984	447	262	27	10%	20	15	10	67%	467	277	37	13%
1985	674	454	37	8%	44	35	6	17%	718	489	43	9%
1986	557	321	30	9%	22	18	6	33%	579	339	36	11%
1987[a]	226	135	10	7%	20	18	8	44%	246	153	18	12%
1988	133	56	6	11%	3	2	0	--	136	58	6	10%

[a] Most of registration permit area was included in drawing hunt area beginning in fall 1987.

STUDY AREA

GAME MANAGEMENT UNIT: 9 (44,500 mi^2)

GEOGRAPHIC DESCRIPTION: Alaska Peninsula

BACKGROUND

The Alaska Peninsula is a premiere 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 the unit, an active guiding industry developed during the 1960's. As hunting pressures increased, several studies on brown bear ecology were initiated. During the late 1960's and early 1970's ADF&G engaged in research at McNeil River State Game Sanctuary to investigate reproductive biology and survival rates of brown bears. A succession of graduate students from Utah State University studied bear behavior at McNeil River during the early 1970s.

Another intensive study was conducted during the early 1970's near Black Lake (i.e., central portion of Subunit 9E). Several hundred bears were captured and marked to acquire information on reproductive performance, movements, and harvest rates. More recently, efforts have been directed at further analysing the data from this study to better understand the population dynamics of an exploited bear population.

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 large number of marked bears killed in the Black Lake area also supported such a reduction. 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 (i.e., open in the fall of odd years and the spring of even years) was adopted to keep harvests within the quota of 150 bears per year for the area south of the Naknek River. This system reduced harvests substantially during the mid-1970's and allowed the bear population to recover during the late 1970's. Since then both the bear population and harvests have increased.

In 1984 the Board abandoned the harvest quota (150 bears) for the area south of the Naknek River, endorsing more flexible populations objective (Sellers and McNay 1984): (1) To maintain the maximum opportunity to hunt bears and avoid implementing 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 is not likely to jeopardize the entire season; and (4) handle chronic bear threats to

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

The Alaska Supreme Court issued a ruling in the fall of 1988 declaring the exclusive guide area system unconstitutional. This ruling potentially means that the number of registered guides operating in Unit 9 could increase drastically for the 1989 fall season. Federal land management agencies have agreed not to issue commercial use licences to new guides; however, a number of new guides are preparing to hunt either on state or private lands.

POPULATION OBJECTIVES

To maintain a high-density population with a sex and age structure that will sustain a harvest composed of 60% males with 50 males ($\geq$8 years old) harvested during the combined fall and spring seasons.

METHODS

Historically, brown bear managers have relied heavily on interpretation of harvest statistic (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. Work is continuing on this approach (Miller and Miller 1988), but it is already apparent that inherent problems with the use of harvest data exist and supplementary means of detecting changes in heavily exploited bear populations are needed.

Aerial surveys of bears concentrated along salmon streams have been periodically used 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 subsequently conducted near Black Lake by ADF&G, in the Becharof, Ugashik and Izembek areas, and in Katmai National Park by NPS. The FWS has conducted additional brown bear research at Becharof and Izembek National Wildlife Refuge. Results of these studies are pending a final year of radio tracking. The ADF&G entered into a cooperative agreement with the FWS and NPS to conduct a comprehensive study near Black Lake. This study began in June 1988, and an initial progress report has been submitted (Miller and Sellers, in press).

RESULTS AND DISCUSSION

Population Status and Trend

The brown bear population in Unit 9 was depressed during the mid-1970's because of high harvests, weak salmon escapements, and severe winters. With the reduced harvests during the late 1970's, bear densities increased, reaching an all-time high by 1985. Although the population remains high, growth has stopped or declined in some areas. Aerial surveys at Black Lake in 1988 (Table 1) showed the single highest count ever (217 bears), but the mean for all 4 replicate counts (171, SE = 26) and the average number of bears observed per hour (51.2) have not significantly differed since 1983. The proportion of single bears (27%) was the lowest recorded since surveys resumed in 1982, reflecting an increasing harvest rate (Sellers 1986). Counts by the FWS at Becharof and Ugashik Lakes and on Izembek NWR were much lower than the peak counts of the mid-1980's, but changes in survey procedure may account for some of the decrease noted in 1988.

Population Size:

Brown bear densities vary within Unit 9; generally, they are lower in northwestern Subunit 9B and higher in the salmon-rich drainages of Subunits 9C and 9E. Data from the Black Lake study in the early 1970's, which were used to reconstruct the minimum population density for 1972 and 1973 (i.e., 1 bear/5-6 mi^2), agreed with the original estimate (i.e., 1 bear/6 mi^2) (Miller and Ballard 1982). This estimate will be compared to the one generated from a census of the Black Lake area that will be completed in 1989; following that census, Unit 9 will be stratified and a total population estimate extrapolated. By comparing habitat types in Unit 9 with other areas in Alaska where censuses have been done, I estimate that densities on the Alaska Peninsula fall within the range of 1 bear/4-15 mi^2.

Population Composition:

The composition of 686 bears classified during 4 replicate counts at Black Lake (Table 1) showed improved cub production over 1986. The percentage of single bears (27%) at Black Lake was lower than the 37% average for the area (1982-87) and the 54% and 61% single bears observed in the essentially unhunted populations at Katmai National Park (NPS files) and McNeil River (ADF&G files), respectively.

Mortality

Season and Bag Limit:

The open seasons in Subunit 9C (i.e., Naknek River drainage) for subsistence, resident, and nonresident hunters are 1 May to 30 June and 1 September to 31 October. The bag limit is 1 brown

bear every 4 regulatory years. The open seasons in Subunit 9D (i.e., south and west of a line from Moffet Point to the eastern entrance of Kinzarof Lagoon and north of aline from the base of Cape Glazenap to Frosty Peak to the mouth of Old Man Lagoon) for resident and nonresident hunters are 10 May to 30 June and 7 to 31 October. The bag limit is 1 bear every 4 regulatory yeras by registration permit only. This hunt will be held only if nuisance bears are present in the area. Hunt dates, if any, will be scheduled by announcement of the Commissioner. No permits were issued by 1988. There is no open season for the remainder of Subunits 9C and 9D, and Subunit 9A, 9B, and 9E for subsistence, resident, and nonresident hunters.

Human-induced Mortality:

The reported harvest was 254 brown bears, including 171 males (67%), 76 (30%) females, and seven (3%) unspecifieds. The 242 brown bears harvested during the spring season represented the 3rd-highest harvest ever recorded; 264 brown bears were harvested for the fall 1987 season. Thus the combined spring 1987-fall 1988 harvest totaled 518 bears that were taken during 5-weeks of the hunting season, representing the largest biannual harvest ever for Unit 9 (Table 2). The fall harvests have increased the most dramatically; the 1987 harvest was 79% higher than those reported for 1973, 1974, and 1975. Spring harvests have also shown an increasing trend, except 1986 when extremely inclement weather during the 1st week of the season reduced hunter success.

In addition to the reported hunter harvest, another 12 bears were killed in nonsporting circumstances. The actual nonsport mortality is estimated at 30-50 bears.

Average skull size for males taken during the 1988 spring season was 25.5 inches, the highest average since 1971. The average female skull size was 21.5 inches, similar to the 21.8 inch long-term average for spring hunts. The 1988 average male age was 6.4, nearly 2 years younger than the average age for 1986, while the average skull size increased. For females, the 1988 average age was 2.3 years younger than the 1986 sample, yet the average skull size was similar; however, age determinations for the 1988 harvest may be suspect, because a new person read the sectioned teeth. Until the aging technique can be further evaluated, additional analysis of age structure in the harvest is not warranted.

Hunter Residency. In 1988, 69% of the brown bears harvested were taken by nonresidents, compared with the 70% average since 1961. Because of complicated logistics and the high cost of hunting in the southern half of Unit 9, fewer residents hunt this area; in 1988, 79% of successful hunters were nonresidents.

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. During the spring of

1988 several juvenile brown bears were frequenting the settled areas of the Naknek drainage, but none of the 12 permittees killed one. During the summer of 1988, at least 8 bears, including 2 entire families, were destroyed in DLP incidents. With the increased level of problem (i.e., nuisance) bears and local press coverage, 60 permits were issued for the fall season and 12 bears were killed (6 males, 6 females); all but one of these were subadults. Circumstances suggest that six of the 12 were problem bears. This registration hunt has been conducted for the past 13 years, and it has been partially successful in reducing the threat of problem bears.

The registration permit hunt in the Cold Bay area was also designed to minimize bear-human conflicts. In 1983 the Izembek National Wildlife Refuge staff expressed concern that the number of local brown bears was too low; they believed that problem bears were no longer common. Consequently, the Board of Game authorized this hunt to be held only when it was determined that problem bears were present. The hunt has not been held since the spring of 1984.

Harvest Chronology. In 1986 harsh weather predominated during the 1st week of the season, and only 73 brown bears were taken. During the remainder of the season, 114 bears were taken. In 1988 the split was more even with 110 bears harvested during the 1st week and 123 thereafter.

Natural Mortality:

Within the Black Lake study area 3 maternal females and at least 1 yearling were known to have died of natural causes (Miller and Sellers, in press).

Game Board Actions and Emergency Orders

During the March 1989 meeting, the Board considered a staff proposal to halt the expanding harvests in Unit 9. The recommended option was to delay the opening of the 1989 fall season to 7 October; i.e., the opening day of the fall season from 1973 to 1983. This proposal was justified on the basis of the rapidly growing fall harvests, the higher percentage of females taken during the 1st week of October (Sellers 1988), and the likelihood that a significant number of new guides would be operating in Unit 9 following the recent Alaska Supreme Court ruling. Despite these facts, the board voted four to three against such a change in the season. The Department made it clear to the Board that if the fall 1989 harvest increased as expected, corrective measures (i.e., Emergency Order) curtailing the spring 1990 season may be necessary.

The Board adopted a joint proposal (ADF&G and FWS) to modify the Cold Bay bear hunt from a strictly nusiance control hunt to a standard regisistration hunt with the same dates as the rest of Subunit 9D begining in fall 1989. A quota of 2 bears per season

was set; if fewer than 2 were harvested in the fall, the balance would carry over to the following spring quota. It was also agreed that in the event the fall quota was exceeded before an Emergency Closure could be effected, the subsequent spring quota would remain at 2 bears.

CONCLUSIONS AND RECOMMENDATIONS

Brown brown bear populations do not lend themselves to convenient methods to monitor trends in density or composition. Harvest statistics are useful, but a manager cannot expect to gain a confident appraisal on the status of the population solely from sex and age make up of the harvest. Stream surveys on the Alaska Peninsula should be continued. The Black Lake surveys suggested a relatively stable and high population, but the low percentage of single bears may be a warning sign. In addition, it must be remembered that the biggest increase in harvests have been in the northern half of Subunit 9E where stream surveys suggest a population decline.

When biannual harvests exceeded 430 brown bears in 1965-66 and 1971-72, it was necessary to curtail harvests significantly (Fig. 1). The remedy was to use Emergency Closures and implement short alternate-year seasons. With those very restrictive regulations already in place and hunting pressure expanding, it must be recognized that future corrective measures will unavoidably be disruptive to the guiding industry. When the Department recommended the Board liberalize fall seasons for 1985, we emphasized that the results would be measured against several guidelines. The 1st of these guidelines (i.e., annual Unit 9 harvest of 230 bears) has been exceeded in 3 of the past 4 years. The 2nd guideline for curtailing the season (i.e., adult male:adult female ratio of 1:1 for 2 consecutive fall seasons) has also been met. For the 1985 and 1987 fall seasons a total of 103 adult males and 106 adult females have been taken. Only the last guideline (i.e., the number of trophy sized males) has not been compromised by recent harvests. The long-term harvest objective (i.e., sex ratio of at least 60% males) for combined fall-spring seasons in Unit 9 was only minimally met for 1987-88 (i.e., 61%). The research project at Black Lake will provide much needed data on population size, sex and age composition, natural mortality rates, the impact of harvests, and the effectiveness of stream surveys in monitoring trends in population size and composition.

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Table 1. Brown bear compostition from Black Lake trend counts in Subunit 9E, 1982-88.

Year	Percentage females w/young	Percentage cubs	Percentage yrlgs	Percentage singles	Total sample	Best single survey		Number of replicate counts
						No. of bears	bears/hour	
1982	19	25	16	40	282	148	53.8	2
1983	22	27	19	32	631	173	55.8	4
1984	24	20	16	30	533	171	64.0	4
1985	22	18	28	32	599	215	67.9	3
1986	20	13	24	43	704	202	61.6	4[a]
1987	17	20	19	43	175	147	52.0	1
1988	23	20	30	27	686	217	62.0	4

[a] One imcomplete survey and 1 post peak use.

Table 2. Biannual brown bear harvest in Unit 9, 1961/62 - 1987/88.

Years	Total harvest	Number females	Percentage males	Season length in days	Percentage nonresident
1961/62	276	78	12	528	62
1963/64	321	100	67	546	70
1965/66	435	131	69	546	71
1967/68	374	105	71	486	80
1969/70	250	72	70	233	74
1971/72	473	182	60	94	72
1973/74	383	164	56	46	78
1975/76	378	137	62	47	60
1977/78	372	124	66	31	68
1979/80	370	117	68	31	74
1981/82	404	158	60	31	73
1983/84	426	142	66	31	67
1985/86	441	158	63	37	70
1987/88	518	196	61	37	66

STUDY AREA

GAME MANAGEMENT UNIT: 10

GEOGRAPHICAL DESCRIPTION: Unimak Island (2,600 mi^2)

BACKGROUND

Unimak is the only island in Unit 10 occupied by brown bears. The island is in the Alaska Maritime National Wildlife Refuge (NWR), and it is classified as a wilderness area. Brown bear hunting on Unimak Island was administered by the U.S. Fish and Wildlife Service (FWS) from 1949 to 1979 and by the Department after 1979. Fifteen permits are issued each year; seven for the spring hunt and eight for the fall hunt. The primary management objective for Unimak Island 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.

POPULATION OBJECTIVE

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

METHODS

The FWS has periodically conducted aerial bear surveys on Unimak Island during late summer from 1977 to 1983. These surveys were begun again in 1988. Because of the very low numbers of bears killed, interpretation of harvest data to reflect population status is not possible.

RESULTS AND DISCUSSION

Population Status and Trend

The Unimak Island brown bear population appears to be maintained by natural regulatory mechanisms at a relatively stable level. The 1988 aerial survey by the FWS showed that 57% of the 65 bears observed were not in family groups. The proportion of single bears has consistently ranged between 45% and 57%, reflecting a lightly exploited population (Sellers 1987).

Population Size:

Brown bear population size and density have not been evaluated specifically on Unimak Island. Results of past surveys and extrapolation of density estimates made elsewhere in Alaska suggest a rough estimate of approximately 200 brown bears on the

island. A density estimate derived for the central portion of the Alaska Peninsula in 1989 may be extrapolated to help refine the estimate for Unimak Island.

Mortality

Season and Bag Limit:

The open seasons for resident and nonresident hunters in Unit 10 are 1 to 21 October and 10 to 25 May. The bag limit is 1 brown bear every 4 regulatory years by drawing permit only; 15 permits are issued annually.

Human-induced Mortality:

Of 7 permits issued for the spring of 1987, 5 hunters participated and 3 males were harvested. For fall 1988, 8 permits were issued; 2 permittees reported hunting; and 1 female and 1 male were taken. These levels of participation and harvest are within historic levels (Table 1).

Game Board Actions and Emergency Orders

Following several court cases involving subsistence preference, the Board of Game changed the Unimak Island permit hunt from a drawing-permit to a limited (first-come, first-served) registration system for the fall 1985 and spring 1986 seasons. The Board reverted back to a drawing-permit hunt the following year, because of (1) no data to substantiate any traditional subsistence use of bears on Unimak, (2) several complaints from the public about the registration permit, and (3) administrative problems for the FWS.

CONCLUSIONS AND RECOMMENDATIONS

The brown bear population on Unimak Island appears stable, and the drawing-permit hunt is meeting the management objectives. During the past 6 years, 25% of the harvested bears have been $\geq$10 years old and hunters have reported seeing an average of 8.3 bears while in the field.

The brown bear population estimate for Unimak will be refined by applying knowledge gained from a study of bears on Izembek National Wildlife Refuge and a research project near Black Lake. I recommend late summer aerial surveys be continued to stratify the island for bear densities. Pending results from the Black Lake study and further evaluation of Unimak and Izembek aerial surveys, the population may be adequately monitored by use of relatively low-cost surveys. I recommend retaining the existing drawing-permit system and number of permits issued.

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Table 1. Brown bear harvest data for Unimak Island permit hunt No. 235 in Unit 10, 1983-88.

Year	Permits issued		Did not hunt		Unsuccessful hunters		Bears harvested: males		females		Total kill
	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	
1983	7	8	2	2	2	2	2	1	0	3	6
1984	7	8	5	6	2	1	0	0	0	1	1
1985	7	6[a]	4	0	1	1	2	3	0	2	7
1986	2[a]	8	0	3	0	2	0	3	2	0	5
1987	7	8	2	2	2	1	2	4	1	1	8
1988	7	8	2	6	2	0	3	1	0	1	5

[a] Limited number of permits issued under a registration system.

STUDY AREA

GAME MANAGEMENT UNIT: 11 (14,000 mi^2)

GEOGRAPHICAL DESCRIPTION: Wrangell Mountains

BACKGROUND

Brown bears were considered numerous in Unit 11 until the late 1940's, when federal poisoning programs directed at controlling wolves incidentally reduced bear numbers. Following cessation of wolf control activities, bear numbers increased, and by the mid-1970's bears were abundant.

Brown bear harvests averaged 16 (range = 8-27) bears per year throughout the 1960's and 1970's, but they declined substantially after 1978, when much of Unit 11 was included in Wrangell Saint Elias National Park/Preserve. Since 1979 harvests have averaged 7 bears (range = 5-9) per year.

POPULATION OBJECTIVES

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

METHODS

The brown bear harvest was monitored by sealing skulls and hides of sport-harvested bears. Skulls of sealed bears were measured, sex of bears was determined, a premolar tooth was extracted for aging, and information on date and location of the harvest as well as number of days afield was obtained from successful hunters.

RESULTS AND DISCUSSION

Population Status and Trend

Population data are currently unavailable for brown bears in Unit 11, because no recent surveys or censuses have been conducted. Observations of bears by Department staff and the public suggest a relatively abundant and well-distributed population of brown bears. No population trend is evident.

Population Composition:

Numerous field observations of sows accompanied by cubs suggest that the brown bear population in Unit 11 is relatively productive.

Mortality

Seasons and Bag Limits:

The open seasons for resident and nonresident hunters in Unit 11 are 1 September to 31 October and 25 April to 25 May. The bag limit is 1 bear every 4 regulatory years.

Human-induced Mortality:

Six brown bears (3 males, 1 female, 1 sex unspecified) were reported killed during 1988 (Table 1). The mean age for males was 3.1 years, substantially below the 20-year-mean of 7.1 years.

Hunter Residency and Success. Nonresident hunters took 1 brown bear during 1988, compared to 2 bears in 1987. The annual harvest by nonresidents has declined from an average of 11 (range = 2-18) bears per year between 1961 and 1978 to only 2 (range = 0-6) since 1978. Local residents harvested 1 bear in 1988 and nonlocal Alaskan residents took 4.

Harvest Chronology. One brown bear was harvested during the spring season, and five (83%) were harvested in the fall. From 1961 to 1988 hunters reported taking 300 (84%) bears in the fall, compared with 56 (16%) during the spring. Presumably fall seasons are more popular in Unit 11, because combination hunts for more than 1 species are possible.

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 its spring 1989 meeting the Board extended the spring season by 6 days; i.e., closing on 31 May. Because this action was taken to align the closing date with that in Unit 13, it is not expected to result in a substantial increase in the harvest.

CONCLUSIONS AND RECOMMENDATIONS

From 1961 to 1978 brown bear harvests averaged 16 bears per year; since 1979 harvests have averaged seven per year. The declines in the total and nonresident harvests have resulted from the establishment of Wrangell Saint Elias National Park/Preserve, where National Park Service regulations prohibit sport hunting in portions of the unit designated as "park." Although subsistence hunting by local residents has continued in these areas, aircraft cannot be used to access park areas, effectively closing most of the park to bear hunting. Sport hunting and aircraft access are allowed in areas designated as "preserve."

Since 1961, 61% of the bears harvested were males; however, the percentage of males in the harvest has increased, and since 1979 has composed 64% of the take. Mean age and skull sizes fluctuate

yearly because of the small sample size. Generally speaking, bears taken in Unit 11 have been older and larger than those taken in adjacent Unit 13, where harvest rates are higher.

Bear harvests are currently very low and have little, if any, impact on the unitwide bear population. No change in season dates or bag limits are recommended at this time.

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Table 1. Brown bear harvests in Unit 11, 1973-1988.

Year	Total harvest	Males	(%)	Females	(%)	Unknown	Nonresident hunters	(%)	Season length
1973	17	10	59%	7	41%	0	11	65%	48 days
1974	15	10	67%	5	33%	0	12	80%	48 days
1975	20	12	63%	7	37%	1	12	60%	56 days
1976	27	16	67%	8	33%	3	18	67%	56 days
1977	21	11	52%	10	48%	0	13	62%	56 days
1978	18	10	56%	8	44%	0	12	67%	56 days
1979	6	4	67%	2	33%	0	2	33%	56 days
1980	5	4	80%	1	20%	0	0	0%	56 days
1981	8	2	33%	4	67%	2	2	25%	77 days
1982	8	3	38%	5	63%	0	3	38%	92 days
1983	7	5	71%	2	29%	0	0	0%	92 days
1984	9	3	50%	3	50%	3	4	44%	92 days
1985	6	4	67%	2	33%	0	3	50%	92 days
1986	9	9	100%	0	0%	0	6	67%	92 days
1987	7	4	67%	2	33%	1	2	29%	92 days
1988	6	3	60%	2	40%	1	1	17%	92 days
1961-1987 Totals	356	201	60%	136	40%	19	212	60%	

STUDY AREA

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

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

BACKGROUND

Grizzly bear habitat is extensive in this unit, excluding the highest mountains and the ice fields (approximately 1,500 mi^2). Grizzly bears have been actively sought by hunters in Unit 12 since the turn of the century, at least in the southeastern portion of the area. As guiding activity directed primarily at Dall sheep increased, grizzly bear hunting regulations became progressively more restrictive until the late 1970's; however, in adjacent Subunit 20E during the 1970's, moose populations declined precipitously and grizzly bears were found to be killing over half of all moose calves by early summer.

To temporarily reduce bear predation on declining moose populations, grizzly bear hunting regulations were liberalized substantially during the early 1980's. Bear harvests increased 26% during the mid-1980's; and by the fall of 1988 moose calf survival to 5 months had improved noticeably in eastern Unit 12 and increases in the size of some subpopulations noted. Management objectives call for grizzly bear harvests to be reduced as moose numbers approach stated objectives.

POPULATION OBJECTIVES

To effect temporary reductions in the grizzly bear population or extent of bear predation in areas where it is limiting moose population growth (e.g., fall calf:cow ratios $\leq$30:100).

To sustain harvests of at least 25 grizzly bears unitwide.

To stop or reverse population declines by reducing the harvest after moose populations have increased to desired levels.

METHODS

Harvest data were recorded during mandatory sealing of hunter-killed bears. All grizzly bears taken in Unit 12 had to be sealed by an ADF&G employee or appointed sealer prior to being transported from the unit. Premolar teeth extracted during the sealing process were later aged by ADF&G personnel.

RESULTS AND DISCUSSION

Population Status and Trend

Grizzly bears have never been censused in Unit 12, because the area is largely forested and there are no known seasonal bear concentrations in open areas. Harvests, observations, and hunter reports indicated that bear numbers were stable or declining very slowly as a result of intentionally increased harvests. A decrease in bear numbers is desired to allow depressed moose populations to recover.

Population Size:

The actual number of grizzly bears inhabiting Unit 12 is unknown; however, assuming bear densities approximate to those estimated for adjacent areas (1 bear/25-30 mi^2), Unit 12 probably supports 280 to 340 bears.

Population Composition:

No accurate estimate of population composition can be made from harvest statistics, because of differential susceptibility of sex or age classes of bears. Based upon the ages of bears harvested, old ($\geq$15 years) bears still inhabit the unit as well as good numbers of younger adults and subadults. Incidental observations indicate the presence of sow-cub, sow-yearling, and sow/2-year-old family groups.

Distribution and Movements:

Based upon incidental observations and reports of harvest locations, grizzly bears frequent all portions of Unit 12 with the possible exception of the vast ice fields in the northern Wrangell Mountains. Bears commonly den in the eastern Alaska Range and Mentasta, Nutzotin, and northern Wrangell Mountains as well as in the low, forested hills north of the Alaska Highway.

During early spring, bears commonly move to the glacial river bottoms to dig roots of peavine and to scavenge carcasses of moose and caribou that had died during the winter months. Females accompanied by cubs-of-the-year generally avoid other adult bears at this time (May-Jun) by remaining at high elevations. Bears have been seen throughout the area during the June-July breeding season, when predation on calf moose is the greatest. Bears appear to move back into subalpine habitats in late July as high-elevation berry crops ripen. Grizzly Bears remain there until denning in October or early November. Unusual shortages of staple berry crops caused some bears to return to valley bottoms during the fall of 1987, where they fed on lowbush cranberries and sought human garbage.

Mortality

Season and Bag Limits:

In that portion of Unit 12 north of the crest of the Mentasta Mountains and west of the Nabesna River the open season was 1 September to 30 June, while in the remainder of the unit the open season was 1 September to 10 June. The bag limit was 1 grizzly bear per year, although bears taken in this unit do not count against the bag limit in other units (i.e., 1 bear every 4 years). No person may take more than 1 bear statewide per regulatory year. All grizzly bears taken in Unit 12 must be sealed before they are transported from the unit.

Human-induced Mortality:

Sealing certificates indicate that 12 grizzly bears were harvested in Unit 12 during 1988, compared with 20 in 1987 and the 5-year mean of 23 (Table 1). The reason for this 40% drop in harvest in 1 year is unknown; it may be due to a decrease in the bear population or to less hunting effort, which the Department does not quantify. The decrease may have also resulted from a shift in the fall distribution of bears to areas of lower elevation and more dense cover. If the harvests remain low in 1989 and 1990, the intended reduction in bear densities may have been successful.

Of the 12 bears taken, nine (75%) were males and three (25%) were females, similar to the sex composition of the 1987 harvest (Table 1). No trend in the sex composition of the harvest has been evident in recent years. Five of the 9 males were judged to have been $\geq$5 years, as were two of the 3 females taken. No clear trend in the proportion of adult males in the harvest has been evident over the past 5 years of increased harvests. Although sample sizes are small, there appears to be a clearly declining trend in the number of adult females in the harvests of the past 5 years (Table 1). Only 2 adult females have been harvested in each of the past 2 years.

The grizzly bear harvest was well distributed throughout Unit 12 in 1988. The Chisana River and Tok River drainages each contributed 3 bears, the Nabesna River two, and the Tanana and Robertson Rivers one each. The harvest location for 2 bears was unknown at the time of this report. No bears were reported taken in the White River drainage in 1988, whereas 7 bears were reported there in 1987.

Hunter Residency and Success. Resident Alaskan hunters took 8 (67%) bears, while nonresidents took only four (33%) (Table 1); this distribution has been consistent since 1981, when regulations favoring resident hunters were implemented (i.e., 1 bear/year bag limit). Prior to that time, guided nonresident hunters took most of the bears each year ($\bar{X}$ = 63%, 1974-80)

Harvest Chronology. Four (33%) and 8 (67%) grizzly bears were taken during the spring and fall of 1988, respectively. Three bears were taken in early June; the month of harvest for 1 bear was unknown. Two of the bears taken during spring were males and two were females. Six bears were taken in September and one in October; the harvest date for 1 bear was unknown.

Natural Mortality. Few instances of natural mortality have been noted. Based upon observations in nearby areas, male grizzly bears are suspected of killing cubs. In recent years, 1 observation was reported of an adult male killing a 4-year-old subadult male near Chisana, and another of 2 adult males killing each other near Tetlin.

Habitat Assessment

Nearly all of Unit 12 has suitable grizzly bear habitat; however, unlike other areas in Southcentral and Southeast Alaska, grizzly bears throughout most of the Interior do not have the benefit of consistently strong salmon runs. Instead, vegetation, predation, and scavenging provide sustenance for these bears.

Game Board Actions and Emergency Orders

During the 1970's until 1978, grizzly bear hunting regulations were conservative; i.e., 10 September-10 October and 10-25 May seasons and a 1 bear per 4 regulatory years bag limit. This provided an effective 47-day season. A resident bear tag ($25) was required beginning in 1977.

During the late 1970's, the Board of Game recognized the potential of grizzly bear predation to control growth of reduced moose populations in Unit 12. In 1978 the Board extended the fall bear season to 56 days by opening it on 1 September. During 1979 the bear seasons were further extended to 1 September-30 November and 1 April-31 May (i.e., 92 days). In 1981 the season was again extended to 1 September-10 June; i.e., 102 days. This season remained the same through the spring of 1987. Beginning in 1982 the bag limit was liberalized to 1 bear per regulatory year. Then during 1984 and 1985, the resident bear tag requirement was waived, but it was reinstated beginning in 1986. In 1987 the season in northwestern Unit 12 west of the Nabesna River and north of the crest of the Mentasta Mountains was extended to end on 30 June; i.e., 122 days. The bag limit was 1 bear per regulatory year, and there was a $25 resident tag requirement. To prevent false reporting of harvest locations, an internal sealing requirement was instituted for Unit 12 beginning in 1987.

CONCLUSIONS AND RECOMMENDATIONS

Liberalizations in hunting regulations, particularly the season extensions and bag limit increases in 1981 and 1982,

respectively, have had the desired effect of increasing bear hunting opportunities and harvests. A doubling in the annual harvest by resident hunters has resulted in an overall increase of 26%. The greatest 1-year harvest of 40 bears occurred in 1984, when the resident tag requirement was first waived, indicating the potential effectiveness of that short-lived regulatory change.

The strategic goal of providing maximum opportunity to hunt grizzly bears is currently being met in Unit 12. The objective of harvesting at least 25 bears per year in the unit may not be achievable at this time, and it was not met this year.

For the first time, harvest statistics indicate that attempts to temporarily reduce grizzly bear numbers may have been successful. The number of mature females in the harvest has declined over the past 5 years, and the total 1988 harvest declined 40% from that of the previous year. Similarly, low harvests in 1989 and 1990 would indicate that an actual reduction in bear density has been achieved. Continued improvement in moose calf survival to 5 months of age would indicate a decrease in grizzly bear predation on calves or a reflection of reduced bear densities.

Whereas it would be preferable to effect recovery of area moose populations through a more balanced wolf and grizzly bear management program, political realities have dictated a high level of protection for the wolf population in Unit 12. To be able to meet anticipated increases in subsistence demands for moose, recruitment must remain sufficiently high to meet current human demands and to provide for population growth. Until moose population objectives are achieved, the present management of grizzly bears should continue. No changes in the present liberal grizzly bear hunting seasons or bag limits are recommended at this time.

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Table 1. Harvests of grizzly bears in Unit 12, 1984-88.

Year	No. harvested (%)			No. males (%)		No. females (%)		No. spring	No. fall
	Total	Res.	Nonres.	Total	≥5 yrs.	Total	≥5 yrs.		
1984	40	24(60)	16(40)	24(62)	8(33)	15(38)	9(60)	16(40)	24(60)
1985	21	13(62)	8(38)	9(45)	5(63)	11(55)	7(64)	4(19)	17(81)
1986	22	14(64)	8(36)	10(45)	4(40)	12(55)	3(25)	4(18)	18(82)
1987	20	14(70)	6(30)	15(75)	5(38)	4(25)	2(50)	4(20)	16(80)
1988	12	8(67)	4(33)	9(75)	5(56)	3(25)	2(67)	4(33)	8(67)
Mean	23	15(65)	8(35)	13(60)	5(46)	9(40)	5(53)	6(26)	17 (74)

STUDY AREA

GAME MANAGEMENT UNIT: 13 (23,000 mi^2)

GEOGRAPHICAL DESCRIPTION: Nelchina Basin

BACKGROUND

The brown bear harvest in Unit 13 has increased substantially over the years. The average annual harvests for the periods between 1961 and 1969, 1970 and 1979, and 1980 and 1987 were 39, 58, 109 brown bears, respectively. Interest in brown bear hunting by recreational hunters was high between 1980 and 1987, when various season and bag limit liberalizations were implemented. After the bag limit was reduced in 1987, both hunter interest and harvests declined.

POPULATION OBJECTIVES

To maintain a population of 1,200 brown bears with a sex and age structure that will sustain a harvest composed of at least 50% males.

METHODS

The brown bear harvest was monitored by sealing skulls and hides of bears killed by hunters. Skulls of sealed bears were measured, sex of bears was determined, a premolar tooth was extracted for aging, and information on date and location of harvest and time spent afield were obtained from successful hunters.

RESULTS AND DISCUSSION

Population Status and Trend

Brown bears were considered numerous in Unit 13 by the mid- to late 1970's, and the population was probably increasing. During this period, the unit was considered by some to have high bear densities for an Interior area (Ballard et al. 1980). The increase in the bear population was probably halted after 1980 when harvest rates increased. Since 1980 evidence suggests bear numbers have been declining in the more accessible, heavily hunted portions of Unit 13. As a result the unitwide bear population is lower than the one that preceded the liberalized harvests.

Population Size:

The 1st density estimate for brown bears was obtained during a brown bear transplant along the Upper Susitna River in Subunits 13B and 13E (1979). The resulting estimate was 1 bear/16 mi^2 and 1 bear $\geq$2.0 years of age/30 mi^2 (Miller and Ballard 1982, Miller 1988). A 2nd 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 et. al. 1987) in Subunit 13E.

In 1987 a new density estimate was obtained for a 505-mi^2 portion of the Upper Susitna River Study Area (1,326 mi^2) to determine if bear numbers had changed since 1979 (Miller 1988). An estimated density of 1 bear/37 mi^2 (1 bear $\geq$2.0 years/58 mi^2) was obtained, suggesting that the density in the upper Susitna was roughly half of that in 1979. The density estimates obtained in 1985 and 1987 were applied to the rest of Unit 13, using a subjective stratification of the unit (Miller 1988), resulting in a population estimate of 1,228 brown bears, of which 823 bears were $\geq$2.0 years of age.

Population Composition:

Miller (1987) reported that during the Susitna Hydroelectric project studies, the observed brown bear litter sizes averaged 2.1 cubs-of-the-year and 1.7 yearlings and 2-year-olds. The estimated mean reproductive interval was between 3.4 and 3.8 years, and the observed age at first reproduction was 4.5 years. Based on these reproductive parameters, the brown bear population in Unit 13 has a fairly high reproductive potential for the Interior.

Distribution and Movements:

Miller (1987) reported minimal average home range estimates of 749 mi^2 for males and 193 mi^2 for females. He noted a pattern of subadult dispersal, where 2- or 3-year-old males typically move away from the home range of their mother, whereas female offspring utilize their maternal home ranges. He also observed movements that would suggest some brown bears move onto caribou calving grounds during calving. Considerably more information is available on movements and home ranges of bears that have been radio-collared for various research projects in Unit 13. Spraker et al. (1981), Ballard et al. (1982), and Miller and Ballard (1982) reported results from some of these studies.

Mortality

Season and Bag Limit:

The open season in Unit 13 for resident and nonresident hunters is 1 September to 31 May. The bag limit is 1 bear every 4 regulatory years.

Human-induced Mortality:

The reported 1988 sport harvest of brown bears was 67; in addition, two were reported killed in defense of life and property (DLP). The sport harvest was composed of 44 (68%) males, 21 (32%) females, and 2 unspecifieds (Table 1). The mean skull sizes were 20.7 inches for males and 19.5 inches for females. The mean ages for all males and females were 4.9 and 5.2 years, respectively. These values are below the 19-year averages of 6.0 and 7.0 years for males and females, respectively. The mean age for both sexes in the current harvest declined substantially; although interpretation of age data is difficult, the decline reflects fewer older bears in the population.

Hunter and Residency and Success. Nonresident hunters took 28 (42%) bears in 1987, slightly below the 5-year average nonresident harvest of 33 bears per year. To evaluate hunting effort on brown bears, the Department sent out a hunter questionnaire for the 1985 and 1986 seasons (Miller 1989). Based on questionaire returns, the estimated success rates for nonresident hunters throughout the state during 1985 and 1986 were 52.5% and 53.5%, respectively. These values are close to the estimates of 51.9% and 50.7%, respectively, based on sealing and tag sales data. Resident hunters in 1985 and 1986 had respective success rates of 5.9% and 5.8%, based on questionnaire results, and 10.2% and 8.5% respectively, based on statewide sealing and tag sales data. Based on the questionnaire results, estimated success rates in 1985 and 1986 for residents and nonresidents were 4.3% and 33.3%, respectively.

Harvest Chronology. Forty-eight (72%) bears were taken during the fall, and 19 (28%) were taken during the spring (Table 2). Males composed 74% (14) and 65% (30) of the spring and fall harvests, respectively. During the spring, the percentage of females progressively increased each week of the season, and during the last week of the season more females were taken than males.

Natural Mortality:

Miller (1987) reported average natural mortality rates of 38% for cubs-of-the-year and 22% for yearlings. He also documented intraspecific predation by brown bears as a source of natural mortality, especially in cubs and yearlings. Although cub survival may be density dependent at certain densities, Miller (1988) concluded that his data did not show a relationship between cub survivorship and increased bear harvests in Unit 13.

Habitat Assessment

Recent monitoring of bears in the vicinity of the intensive mining operation at Valdez Creek indicate bear avoidance of the area (Miller 1988). Development activity in remote areas will

probably reduce or eliminate their suitability to support brown bears. 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 dramatically over the past 10 years, under land disposal programs conducted by the Alaska Department of Natural Resources and the federal government. The continued increase in the number of remote cabins will adversely affect brown bears in Unit 13.

Game Board Actions and Emergency Orders

Prior to 1980 brown bear management in Unit 13 was directed at maintaining sustained-yield harvests and providing the greatest opportunity to participate in hunting brown bears; seasons were generally short, and there was no spring season. In 1980, after research data suggested that reduced brown bear numbers could increase moose calf survival (Ballard and Larson 1987) the Board of Game began to liberalize seasons in Unit 13, including opening a spring season. In 1982 the Board liberalized the bag limit to 1 bear per year in order to increase harvests and reduce the population.

Effective for the fall of 1987, the Board reestablished the bag limit of 1 bear every 4 years to reduce the incentive for hunters to report taking bears in Unit 13 that were killed in other units having more restrictive bag limits. Such "bootleg" reporting of bears from Unit 13 reduced our ability to determine population trends because of the resulting inaccurate harvest data.

CONCLUSIONS AND RECOMMENDATIONS

The 1987 population estimate of 1,228 brown bears was used to set the population goal. Additional studies will be necessary to determine if the number of bears has changed. Periodic density estimates should be conducted at approximately 5-year intervals to provide comparisons of trends.

The 1987 population estimate was based on the best density data available; however, unitwide extrapolations of density estimates for 1 or 2 relatively small areas should be used with caution. Although it is reasonable to assume most of the decline in densities observed in the upper Susitna Study Area is attributed to increased sport harvest, additional factors may have had a role. For example, increased gold mining development in the Upper Susitna Study Area since 1979 may have resulted in displacement or increased unreported killing of brown bears from this area.

Brown bear harvests averaged 111 bears per year from 1980 to 1987. Density estimates suggested that (1) the reduction in the unitwide population to 1,200 bears occurred during this period and (2) if the bear population is to be stabilized, harvests will

have to be reduced. A maximum sustainable harvest rate for brown bears was estimated at 5.6%/year (8% for bears ≥ 2.0 years of age) (Miller 1988). Utilizing the 1987 population estimate, the maximum sustainable harvest should therefore be 67 bears per year. Of these, up to 30 could be females, but not more than 21 should be ≥5-year-old females (Miller 1988). The 1988 harvest of 67 brown bears was at the estimated maximum sustainable harvest level for brown bears in Unit 13. The harvest of 21 female bears equalled Miller's (1988) estimated allowable take for 5-year-old females, but it was lower than his estimated total allowable harvest of 30 females.

Harvest composition figures for 1988 showed that males composed 68% of the harvest, well above the management guideline of a minimum of 50%. The average annual proportion of males in the harvest has been 56%. The percentage of males in the spring harvest was especially high, because spring hunters are selective for large bears and male bears are more vulnerable to hunting than females at that time. Male bears leave their dens earlier in the spring, travel more extensively, and after reaching 5 years of age are not protected as are a majority of females (sows with cubs). Early spring hunting is also popular, because snow cover allows access to remote areas by snowmachine or ski plane. Later in the spring access becomes difficult because of breakup.

The sex composition of fall harvests between 1983 and 1987 showed that the number of females exceeded the number of males. Because many fall hunters harvest bears opportunistically in conjunction with hunts for other species, they are less selective and the sex of the bears they take reflects their availability in the population. Since males are considered more vulnerable than females, it is assumed that high female harvests in the fall mean harvests are excessive. In 1988 males exceeded females in the fall, composing 65% of the take. The reason for the increased proportion of males is unclear. The percentage of males in the fall harvests will be closely monitored to assess hunting pressure and availability of males.

The decline in the reported brown bear harvest during 1988 was a direct result of reducing the bag limit from 1 bear per year to 1 every 4 years; whether it will continue at this lower level is unknown. If the total harvest or the harvest of females exceeds estimated sustainable harvest rates, additional hunting restrictions will be needed. Changes in season lengths and dates are recommended as the preferred means to further reduce harvests, if necessary; however, no changes in seasons are currently recommended.

The lack of data on unsuccessful hunting effort and success rates reduces our ability to evaluate bear population trends. Changes in success rates or effort can serve as indications of bear abundance. I recommend that a statewide system of collecting harvest data from unsuccessful hunters be established. A bear harvest report could be handed out when resident or nonresident

bear tags are sold; its return should be required for all unsuccessful bear hunters.

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Table 1. Brown bear harvests in Unit 13, 1978-1988.

Year	Total harvest	Males	(%)	Females	(%)	Unknown	Nonresident harvest	(%)	Season length days
1978	64	37	(60)	25	(40)	2	28	(44)	40
1979	73	39	(53)	25	(40)	0	31	(42)	40
1980	84	42	(52)	39	(48)	3	25	(30)	56
1981	82	51	(64)	29	(36)	2	27	(33)	77
1982	82	47	(57)	35	(43)	0	25	(30)	153
1983	117	63	(56)	50	(44)	4	39	(33)	273
1984	124	69	(58)	49	(42)	6	34	(27)	273
1985	145	76	(54)	66	(46)	3	33	(23)	273
1986	141	74	(53)	65	(47)	2	27	(19)	273
1987	104	51	(55)	42	(45)	11	34	(33)	273
1988	67	44	(68)	21	(32)	2	28	(42)	273

Table 2. Brown bear harvest by season in Unit 13, 1979-1988.

Year	Unit take	Total fall harvest	(%)	Fall males	(%)	Season dates	Total spring harvest	(%)	Spring males	(%)	Season dates
1979	73	73	(100)	39	(53)	1 Sept-10 Oct					No open season
1980	84	69	(82)	33	(50)	1 Sept-10 Oct	15	(18)	9	(60)	10-25 May
1981	82	58	(71)	36	(63)	1 Sept-31 Oct	24	(29)	15	(65)	10-25 May
1982	82	59	(72)	34	(58)	1 Sept-31 Dec	23	(28)	13	(57)	25 Apr-25 May
1983	117	81	(69)	37	(48)	1 Sept-31 Dec	36	(31)	26	(72)	1 Jan-31 May
1984	124	77	(62)	36	(51)	1 Sept-31 Dec	47	(38)	33	(70)	1 Jan-31 May
1985	145	91	(63)	42	(47)	1 Sept-31 Dec	54	(37)	34	(64)	1 Jan-31 May
1986	141	96	(68)	46	(49)	1 Sept-31 Dec	45	(32)	28	(62)	1 Jan-31 may
1987	104	58	(56)	18	(35)	1 Sept-31 Dec	46	(44)	33	(79)	1 Jan-31 May
1988	67	48	(72)	30	(65)	1 Sept-31 Dec	19	(28)	14	(74)	1 Jan-31 May

STUDY AREA

GAME MANAGEMENT UNIT: 14 (6,871 mi^2)

GEOGRAPHICAL DESCRIPTION: Upper Cook Inlet

BACKGROUND

Little information is available on the status of the brown bear population in Unit 14. Because density surveys have never been conducted, population status has been indirectly evaluated by using harvest data and incidental observations of brown bears reported by Department staff and the public. Annual reported harvests have remained low and relatively stable from 1983 to 1988, but harvests increased recently in Subunits 14A and 14B. There are insufficient data to determine the impact of harvest on the bear population, but the low stable harvest rate suggests that the population size has remained stable. In the past 10 years some increase in bear numbers may have occurred in the remote areas of Unit 14.

POPULATION OBJECTIVE

To maintain a population of 160 bears with a sex and age structure that will sustain a harvest composed of at least 60% males.

METHODS

The harvest was monitored by sealing skulls and hides of sport-killed brown bears. Skulls of sealed bears were measured, sex of bears was determined, a premolar tooth was extracted for aging, and information on date and location of harvest and effort was obtained from successful hunters.

RESULTS AND DISCUSSION

Population Status and Trend

No surveys to determine brown bear density have been conducted in Unit 14. Hunters, guides, air taxi operators, interested members of the public, and incidental observations by Department staff indicate that brown bears are relatively scarce in Subunits 14A and 14C but more abundant in Subunit 14B. Sightings have been too infrequent and observations have been too general to detect any population trends. The low frequency of observations suggests that brown bear numbers in general have remained relatively low and stable during the past 5 to 10 years. Because Subunit 14B is more remote and access more limited, it has a higher density of brown bears than Subunits 14A and 14C; however,

in the past 3 years increased reports of bear sightings by the public suggest that bear numbers may have increased in portions of Subunits 14A and 14C. Even so, density still remains relatively low in these subunits.

Populations Size:

Subunit 14C, with a high human population (i.e., 220,000 people), has the fewest bears of the 3 subunits; i.e., less than 40 bears and perhaps fewer than 25. Miller et al. (1987) found that brown bear density along the Susitna River in Unit 13 was approximately 1 bear/13-16 mi^2 and brown bear habitat was almost always below an elevation of 5,000 feet. Miller (pers. commun.) believes that most brown bear habitat in Subunits 14A and 14B also occurs below 5,000 feet. About 85% of these subunits are below 5,000 feet (i.e., areas of 2,268 and 1,746 mi^2 for Subunits 14A and 14B, respectively). If Subunit 14B has a brown bear density of 1 bear/16-20 mi^2 (slightly lower than in Unit 13), the area would contain 87 to 109 bears. Because Subunit 14A is more urban, the brown bear density will be lower than that in Subunit 14B, perhaps 1 bear/20-40 mi^2, or 57 to 113 brown bears. The combined population estimate for Subunits 14A and 14B would then be 144-222 bears.

Mortality

Season and Bag Limit:

The open season for subsistence, resident, and nonresident hunters in Subunits 14A and 14C is 1 September to 10 October. The open seasons for resident and nonresident hunters in Subunit 14B are 1 September to 31 October and 10 to 25 May. The bag limit for all hunters is 1 bear every 4 regulatory years.

Human-induced Mortality:

During 1988 brown bear hunters harvested a record 17 bears (7 in Subunit 14A, 10 in 14B), compared with a mean harvest of 10.6 bears over the previous 5 years (1983-87, Table 1). Mean harvest in Subunit 14A for this period was 2.0 bears, compared with 6.2 bears in 14B (spring and fall combined), and 1.0 bear in 14C. Mortality in Subunit 14C has been split about equally between the sport harvest and bears taken in defense of life or property (DLP). This combined mortality has averaged 2.2 bears per year during the past 6 years (Table 1). Since 1972 the combined harvest (including DLP bears) has typically been 10 bears or less and has exceeded 10 bears on only 2 occasions: 1984 (14) and 1988 (19).

In Subunits 14A and 14B male bears constituted 64% of the harvest in 1988 (Table 2). Over the previous 5 years, the percentage of males in the harvest has ranged from 50% to 71%. The variation in this percentage is probably due to the small sample sizes.

Data on the geographical distribution of the annual harvest by drainage for the past 6 years (1983-88) indicate that brown bears were harvested in the same relative proportions in most of the drainages in Subunits 14A and 14B (Table 3). However, in 1988 the Willow/Deception Creek drainage was an exception; 5 bears were killed in this area, compared with 1 bear during the previous 5 years. This higher harvest may relate to an increase in hunting effort during the fall season. The Sheep River/Iron Creek drainage consistently produced the most bears, with a mean annual harvest of 2.8 bears (range = 2-5); the 6-year mean for each of the other drainages was 1 bear or less.

Because of urban and rural development in Unit 14, particularly in Subunit 14C, the number of DLP bears has been relatively high; in the past 6 years, nine were killed, with eight of the nine killed in Subunit 14C (Table 1). Because people commonly encounter bears along salmon streams, a few bears may have been wounded or killed and the encounters not reported.

Hunter Residency and Success. Residents accounted for most of the 1988 brown bear harvest in Subunits 14A and 14B. Of the 58 bears killed between 1982 and 1988, resident hunters took 47 bears (83%); of the 11 bears taken by nonresidents, 10 (85%) were taken in Subunit 14B.

Harvest Chronology. In 1988, 88% (41% in 14A, 47% in 14B) of the brown bear harvest was taken during the fall hunting season. Over the previous 5 years, 67-100% of the harvest have been taken during fall hunting seasons (Table 5). From 1983 to 1988 there was no spring hunting season in Subunit 14A and only 6 bears were killed in Subunit 14B. In three of these 6 years no bears were taken. Small spring harvests in Subunit 14B are due to limited access and not a lack of bears. Access into the subunit is difficult after 10 May because of poor snow conditions and/or high water in the streams from snow melt.

Of the 41 bears killed in Subunit 14B during the period 1983 to 1988, 35 were taken during the fall hunting season, 32 of which were killed during September moose hunting season. Many of these brown bears were killed by hunters who were hunting sheep, moose, or caribou.

Game Board Actions and Emergency Orders

The present season and bag limits in Unit 14 have been in effect since the 1981-82 regulatory year. In 1987 Department staff submitted a proposal to provide the same brown bear season in Subunit 14B that existed in Unit 13 (i.e., 1 September to 31 May). The Board of Game took no action, pending a comprehensive review of the brown bear regulations.

CONCLUSIONS AND RECOMMENDATIONS

The brown bear harvest in Unit 14 has been relatively small and within sustained-yield parameters in most areas since statehood (1959); i.e., 10 bears or less. From 1972 to 1982 the mean harvest was 5 bears; from 1983 to 1988 it was 12 bears (range = 10-19, Table 1). Because the mean annual harvest for the past 6 years was twice that of the previous 10 years, an assessment of the immediate and long-term impacts on the brown bear population seems warranted, especially in Subunits 14A and 14B where recent increases have occurred.

Using a deterministic model with known reproductive rates from a brown bear population, Miller (1988) estimated exploitation rates for all ages of brown bears under a "no growth" scenario. When he assumed a low natural mortality rate, the maximum sustainable exploitation rate for all bears in the population was 5.6%. As assumption of no natural mortality yielded a sustainable exploitation rate of 8.5% (exploitation rates for females older than 2 years were 5.8% with low natural mortality and 9% with no natural mortality). The estimated brown bear population in Subunits 14A and 14B is 122-222 bears. Assuming a maximum exploitation rate of between 5.6% and 8.5%, 8-19 bears could be harvested annually in these subunits.

Although these allowable harvest estimates are based on several untested assumptions, they are useful for a number of reasons. Subunits 14A and 14B encompass a relatively large and partially remote geographical area, and a 6-year-mean annual harvest of 9.6 bears (Table 1) would not appear to have a significant biological impact. However, by making rough estimates of the population in Subunits 14A and 14B and then subjecting these estimates to Miller's (1988) estimated maximum sustainable exploitation rates, the results suggest that the current annual harvests may be closer to sustained yield than previously thought. It does not appear that sustained yield has been exceeded in Subunits 14A and 14B, but if annual harvests increase above 1988 levels sustained yield may be exceeded.

I do not recommend making any changes in season length or bag limits at this time for the following reasons: (1) the 6-year mean harvest appears to not exceed the estimated sustained yield in most areas and annual harvests have varied little, except in 1988; (2) the percentage of male bears in the harvest has always been higher than 50% (mean = 60%), even though most of the harvest has occurred in the fall when females are more vulnerable; (3) a harvest of 60% males meets the population objective, and the population goal of 160 bears falls within the population estimate of 144-222 bears; and (4) because significant portions of Unit 14 are urban or have relatively high numbers of people living in "rural subdivisions," maintaining relatively low numbers of brown bears minimizes conflicts with people and livestock.

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Table 1. Historical summary of brown bear harvest in Subunits 14A, 14B, and 14C, 1983-88.

Year	Spring[a] 14B No.	Spring[a] 14B (%)	Fall 14A No.	Fall 14A (%)	Fall 14B No.	Fall 14B (%)	Fall 14C No.	Fall 14C (%)	Total	DLP[b]	Total Unit 14[c]
1983	0	(0)	2	(25)	5	(63)	1	(3)	8	1	9
1984	1	(10)	5	(50)	4	(40)	0	(0)	10	4	14
1985	3	(43)	1	(11)	3	(33)	2	(22)	9	1	10
1986	0	(0)	1	(10)	7	(70)	2	(20)	10	0	10
1987	0	(0)	1	(11)	8	(89)	0	(0)	9	0	9
1988	2	(12)	7	(41)	8	(47)	0	(0)	17	2	19
Total	6	(10)	17	(27)	35	(60)	5	(8)	63	8	71
Mean	1		2.8		5.8		.8		9.6	1.3	11.8

[a] Subunits 14A and 14C had no hunting season during the spring.
[b] All bears taken in defense of life or property (DLP) were taken in subunit 14C except 1 in 1984.
[c] Harvest total includes DLP bears.

Table 2. Sex ratio of brown bears harvested[a] in Subunits 14A and 14B, 1983-1988.

Year	14A M	14A (%)	14A F	14A (%)	14B M	14B (%)	14B F	14B (%)	14A and 14B combined M	14A and 14B combined (%)	14A and 14B combined F	14A and 14B combined (%)	Sex unknown	Harvest total
1983	1	(50)	1	(50)	4	(80)	1	(20)	5	(71)	2	(29)	0	7
1984	3	(60)	2	(40)	1	(33)	2	(67)	4	(50)	4	(50)	2	10
1985	1	(100)	0	(0)	3	(60)	2	(40)	4	(67)	2	(33)	1	7
1986	1	(100)	0	(0)	4	(57)	3	(43)	5	(63)	3	(38)	0	8
1987	0	(0)	1	(100)	5	(63)	3	(37)	5	(56)	4	(44)	0	9
1988	3	(60)	2	(40)	6	(67)	3	(33)	9	(64)	5	(36)	3	17
Total	9	(60)	6	(40)	23	(62)	14	(38)	32	(62)	20	(38)	6	58
Mean	1.3		1		3.8		2.3		5.3		3.3		1	9.6

[a] Does not include bears taken in defense of life or property.

Table 3. Distribution of brown bear harvest[a] in Subunits 14A and 14B by major drainage, 1983-1988.

Subunit/ Drainage	1983 No.	1983 % of subunit	1984 No.	1984 % of subunit	1985 No.	1985 % of subunit	1986 No.	1986 % of subunit	1987 No.	1987 % of subunit	1988 No.	1988 % of subunit	Total
14A													
Susitna River (East Bank)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	1	(14)	1
Little Susitna River	1	(50)	0	(0)	0	(0)	1	(100)	0	(0)	1	(14)	5
Palmer, Big Lake Knik Arm	0	(0)	2	(40)	0	(0)	0	(0)	1	(100)	0	(0)	1
Matanuska River (West Bank)	1	(50)	2	(40)	1	(100)	0	(0)	0	(0)	0	(0)	4
Upper Willow Cr./ Deception Cr.	0		1	(20)	0	(0)	0	(0)	0	(0)	5	(71)	6
Total	2		5		1		1		1		7		17
14B													
Sheep River/Iron Creek	0	(0)	4	(80)	2	(33)	3	(43)	5	(63)	4	(40)	14
Talkeetna River (S.E. Bank)	0	(0)	0	(0)	2	(33)	2	(29)	1	(12)	2	(20)	5
Sunshine Creek	0	(0)	0	(0)	0	(0)	1	(14)	0	(0)	2	(20)	1

Table 3. Continued

Subunit/ Drainage	1983 No.	1983 % of subunit	1984 No.	1984 % of subunit	1985 No.	1985 % of subunit	1986 No.	1986 % of subunit	1987 No.	1987 % of subunit	1988 No.	1988 % of subunit	Total
Montana Cr/Sheep Cr.	2	(40)	0	(0)	0	(0)	0	(0)	2	(25)	0	(0)	4
Kashwitna River	3	(60)	1	(20)	1	(17)	0	(0)	0	(0)	0	(0)	5
Willow Creek/ Little Willow Cr.	0	(0)	0	(0)	1	(17)	1	(14)	0	(0)	2	(20)	2
Total	5		5		6		7		8		10		31
Grand Total	7		10		7		8		9		17		41

[a] Does not include bears taken in Defense of Life and Property (DLP).

Table 4. Residency of successful brown bear hunters in Subunits 14A and 14B, 1983-1988.

Subunit	Year	Resident No.	Resident (%)	Nonresident No.	Nonresident (%)	Total
14A	1983	1	(50)	1	(50)	2
	1984	5	(100)	0	(0)	5
	1985	1	(100)	0	(0)	1
	1986	1	(100)	0	(0)	1
	1987	1	(100)	0	(0)	1
	1988	7	(100)	0	(0)	7
	Total	16	(90)	1	(10)	17
	Mean	2.6		0.2		2.8
14B	1983	5	(100)	0	(0)	5
	1984	4	(80)	1	(20)	5
	1985	3	(50)	3	(50)	6
	1986	7	(100)	0	(0)	7
	1987	6	(75)	2	(25)	8
	1988	6	(60)	4	(40)	10
	Total	31	(81)	10	(19)	41
	Mean	5.2		1.6		6.8
14A & 14B combined	1983	6	(86)	1	(14)	7
	1984	9	(90)	1	(10)	10
	1985	4	(57)	3	(43)	7
	1986	8	(100)	0	(0)	8
	1987	7	(78)	2	(22)	9
	1988	13	(76)	4	(24)	17
	Total	47	(83)	11	(17)	58
	Mean	7.8		1.8		9.6

Table 5. Chronology of annual brown bear harvest in Subunits 14A and 14B, 1983-1988.

Subunit	Date	Year 1983 No.	1983 (%)	1984 No.	1984 (%)	1985 No.	1985 (%)	1986 No.	1986 (%)	1987 No.	1987 (%)	1988 No.	1988 (%)	Total No.	Total (%)
14A	Sept. 1-8	1	(50)	3	(60)	0	(0)	0	(0)	0	(0)	1	(14)	5	(29)
	9-15	1	(50)	1	(20)	0	(0)	0	(0)	0	(0)	4	(57)	6	(35)
	16-22	0	(0)	1	(20)	0	(0)	0	(0)	1	(100)	2	(29)	4	(24)
	23-30	0	(0)	0	(0)	1	(100)	1	(100)	0	(0)	0	(0)	2	(12)
	Total	2		5		1		1		1		7		17	
14B Spring	May 16-20	0	(0)	1	(100)	2	(67)	0	(0)	0	(0)	1	(50)	4	(67)
	21-25	0	(0)	0	(0)	1	(33)	0	(0)	0	(0)	1	(50)	2	(33)
	Total	0		1		3		0		0		2		6	
14B Fall	Sept. 1-8	1	(20)	0	(0)	1	(33)	1	(14)	3	(38)	4	(50)	10	(29)
	9-15	3	(60)	2	(50)	0	(0)	4	(57)	0	(0)	3	(38)	12	(34)
	16-22	0	(0)	1	(25)	2	(67)	2	(29)	2	(25)	0	(0)	7	(20)
	23-30	0	(0)	0	(0)	0	(0)	0	(0)	2	(25)	1	)12)	3	(9)
	Oct. 1-8	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
	9-15	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)
	16-31	1	(20)	1	(25)	0	(0)	0	(0)	1	(12)	0	(0)	3	(9)
	Total	5		4		3		7		8		8		35	
Grand Total		7		10		7		8		9		17		58	

STUDY AREA

GAME MANAGEMENT UNIT: 16 (12,445 mi^2)

GEOGRAPHICAL DESCRIPTION: West side of Cook Inlet

BACKGROUND

Brown bears occur throughout Unit 16; however, they are most abundant in the foothills of the Alaska Range. Prior to the 1984-85 regulatory year, conservative seasons resulted in low harvests. With liberal seasons, harvests increased significantly as hunters targeted prime hunting times and guides began offering both spring and fall hunts. Harvest levels have since declined, in response to the reduced availability of older-age-class brown bears.

POPULATION OBJECTIVES

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

METHODS

The brown bear harvest was monitored by sealing skulls and hides of harvested brown bears. Skulls of sealed bears were measured, sex of bears was determined, a premolar tooth was extracted for aging, and information on the date and location of the harvest and hunter effort was obtained from hunters. Harvest data were compared with those of previous years.

RESULTS AND DISCUSSION

Mortality

Season and Bag Limits:

The open season in Unit 16 for resident and nonresident hunters is from 1 September to 25 May. The bag limit is 1 bear every 4 regulatory years.

Human-induced Mortality:

The 1988 harvest of 59 bears is the smallest since the season dates were liberalized in 1985 (Table 1). The percentage of males in the harvest increased from 59% in 1987 to 67% in 1988, and the mean male skull size increased from 23.1 to 23.3 inches; however, the mean age of males declined slightly from 7.3 years to 7.0 years. The percentage of breeding-age females ($\geq$5 years) in the harvest was 14%, similar to last year's value of 13%. The spring harvest was 85% males, and the fall harvest was 50% males. No bears were reported taken in defense of life and property.

Hunter Residency and Success. The proportion of the harvest by nonresidents increased slightly from 58% in 1987 to 61% in 1988.

Harvest Chronology. Twenty nine bears were taken during the spring season, 76% of these in April; the earliest was taken on 29 March. The harvest peaked in the last 2 weeks of April. Only 4 bears were taken after 10 May. During the fall, 93% of the harvest (28 bears) occurred in September; the last one reported was for 29 October.

Transport Methods. Aircraft was the most common mode of transportation reported by successful hunters. In the spring and fall, 27 (93%) and 23 (77%) bears were taken using aircraft, respectively. Other methods of transportation associated with hunting for other species were also utilized. In Subunit 16B, 87% of successful hunters used aircraft, compared with 50% in Subunit 16A.

CONCLUSIONS AND RECOMMENDATIONS

In response to season changes, brown bear harvests in Unit 16 have gone through a period of adjustment. Prior to 1984, annual harvests were low and few old males were taken in the spring. During the conservative 10-25 May season, older males were difficult to locate, because they had already left their dens and melting snow conditions severly restricted hunter access. With the earlier spring seasons and the abiltiy to time hunts to coincide with spring den emergence, hunters were able to take many old males. In the 10 years prior to 1985, spring seasons averaged only 4 bears. From 1985 to 1988 they have produced 35, 29, 38, and 29 bears, respectively.

The average fall harvest during the 10-year period prior to 1985 was 24 bears. Since 1985 the annual fall harvest has increased to an average of 47 bears, reflecting additional hunting pressure by both resident and nonresident hunters. Unlike the spring season when the opportunity to hunt earlier caused larger harvests, additional hunting time after September has resulted in little additional harvest. Since 1985, 85% of the fall harvest has occurred in September. In 1988 only 2 bears were taken in October. The doubling of the fall harvest reflects public awareness of the unit's brown bear resources and a more active guiding industry.

The distribution of the harvest since 1985 has changed little from that seen in the prior 10 years. Subunit 16A, which averaged 13% of the harvest, still contributes only a small portion (8%); the Peters-Dutch Hills area provides most of it. In Subunit 16B, the same 3 large areas produce most of the harvest: (1) the Skwenta-Lake Creek drainages that yielded 43% prior to 1985 now yields 39%; (2) the area west of the Beluga River increased from 31% to 35%; and (3) Mount Susitna increased

from 4% to 6%. Few brown bears are taken from the lowland forest or from other areas having good habitat but poor hunter access.

The liberalized season has encouraged increased guiding activity. The 10-year average harvest by nonresidents prior to 1985 was 11 bears. In the last 4 years (i.e., 1985-1988), nonresidents have taken 34, 34, 54, and 36 bears, respectively. The greatest change occurred in the spring; nonresidents harvested only 8 bears during the 10 years prior to 1985, compared with 75 bears during the spring from 1985 to 1988. With shorter spring seasons it was not economically viable for some guides to offer hunts. In the 10 years prior to 1985, an average of 7.2 individual guides was successful in obtaining bears for their clients; the number has never exceeded 10.0. In 1985, 14.0 individual guides were successful; in 1986, 18.0 guides; in 1987, 15.0 guides; and in 1988, 15.0 guides. The number of guides with 2 or more successful clients in a calendar year increased from an average of 2.4 (range zero to 6) before 1985 to 6.0 in 1985, then 7.0, 10.0, and 10.0 in subsequent years, respectively.

The average age of harvested bears is younger now than they were immediately after the seasons had been liberalized. The mean age for males jumped from 6.3 in 1984 to 8.8 years in 1985. Since then the mean male ages have gradually declined to 7.0 years. Older males remained common in the 1988 spring season (mean age of 8.3), but younger males predominated in the fall (mean age of 4.8). The young age structure and the 50-50 representation of the sexes in the harvest indicates the opportunistic nature of fall brown bear hunting.

The majority of the spring harvest occurs when the females and younger males are still in their dens. By the time these bears emerge, melting snows have restricted hunter access. The number of mature females ($\geq$5 yrs) in the harvest (8 in 1988) is not excessive. Data are lacking on the population response to the increased harvest and reduction of older males in that harvest. Brown bear habitat has been unaltered by competing land uses, retaining a high potential to produce bears.

The established management objective is not directed at maintaining a maximum population of brown bears or one dominated by older age classes. Management should maintain an adequate population to provide for varied recreational uses of the resource, including hunting. Adjustments in the season may be recommended if data and field observations suggest reduced harvests are necessary, but no changes are recommended at this time.

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Table 1. Annual brown bear harvest in Unit 16, 1983-1987.

Year	No. males	No. females	No. unid	Total	Mean male age	Mean male skull Size
1984	24	6	3	33	6.3	22.2
1985	57	30	6	93	8.8	23.6
1986	49	19	5	73	7.9	23.6
1987	51	35	7	93	7.3	23.1
1988	37	18	4	59	7.0	23.3

STUDY AREA

GAME MANAGEMENT UNIT: 17 (20,350 mi^2)

GEOGRAPHICAL AREA: Northern Bristol Bay

BACKGROUND

No data on brown bear populations or annual harvests are available prior to 1961. Observations by long-term local residents indicated moderate-to-high populations that have increased during the past 10 years.

Documented use of brown bears since 1961 has been almost exclusively by sport hunters. While subsistence use has been very light, Behnke (1981) indicated that it was significant, and an extended subsistence season was established in Subunits 17A and 17C by the Board of Game for the 1986-87 regulatory year. Sport hunting pressure was light prior to 1973, when alternate-year seasons established for Unit 9 caused a shift in hunting pressure to Unit 17 during the closed seasons in Unit 9. Expanded fall season dates since 1983 and steady increases in the moose and caribou populations in Subunit 17B have made this area attractive to guides selling combination hunts, resulting in annual harvests twice those prior to 1983.

POPULATION OBJECTIVES

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

METHODS

Sex and age data were collected for each brown bear reported harvested in Unit 17. These data were analyzed and compared to those of previous years to determine if any trends were apparent in the number, sex composition, or age structure of the harvested bears. Effects of season lengths and dates were considered to determine effects of the increased length of the fall season from 1984 to 1988.

RESULTS AND DISCUSSION

Population Status and Trend

Unit residents reported moderate-to-high densities of brown bears throughout Unit 17. The densities appear to be especially high in Subunit 17C in the Nerka and Beverly Lakes area during August and September. Sport fishing guides reported seeing significantly fewer brown bears in the upper Nushagak River

portion of Subunit 17B during the during fall of 1988 than they had in previous years.

Mortality

Season And Bag Limit:

The open seasons for subsistence, resident, and nonresident hunters in Subunits 17A and 17C are 10 September to 10 October and 10 April to 25 May. The open seasons for hunters in Subunit 17B are 10 to 25 May and 10 to 25 May. The bag limit for all hunters in Unit 17 is 1 bear every 4 regulatory years.

Human-induced Mortality:

Hunters reported taking 45 brown bears; 29 (66%) were males and 15 (33%) were females. Nine were taken in Subunit 17A, 37 in Subunit 17B, and three in Subunit 17C. An additional 4 bears were either taken illegally or in defense of life and property.

The annual harvest level of brown bears in Unit 17 was not significant until 1970. The average annual harvest since then has been 24.9 bears. In 1985 the annual harvest increased dramatically to 57 bears. It has remained high, averaging 52 bears per year from 1985 to 1988.

The average age of males taken in 1988 was 7.8 years; females averaged 6.3 years. Both sexes were below average age for all years since 1969. No trends in average age of either sex were apparent in the spring and fall seasons or yearly totals.

Harvest Chronology. Except for 9 males taken during the spring season, the entire harvest occurred during the fall.

Hunter Residency. Nonresidents took 72% of the harvest.

CONCLUSIONS AND RECOMMENDATIONS

Season dates have changed almost annually for brown bears in Unit 17 since 1983. With the exception of expanding the fall season (i.e., from 7 October-21 October to 10 September-10 October, most changes have had little effect upon the level of harvest. The addition of 20 days in September to the season allowed guides to book "combination" hunts, because the seasons for moose and caribou were open for at least a portion of the brown bear season. Because of increased vulnerability of females during the fall, females composed a major portion of the increased harvest. Prior to the season change, the percentage of females in the annual harvest averaged 33.8% (1979-1983). Once the September season was established, this figure increased to 52.8% (1984-1988). Harvest chronology indicated that all females taken in 1987 and 87% of those taken in 1988 were harvested during

September. Because of the increase in harvest and the increased percercentage of females in the harvest, particularly in Subunit 17B, ADF&G staff proposed to the Board of Game to delete the 10 September-19 September portion of the season.

LITERATURE CITED

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STUDY AREA

GAME MANAGEMENT UNIT: 18 (46,000 mi^2)

GEOGRAPHICAL DESCRIPTION: Yukon-Kuskokwim Delta

BACKGROUND

The brown bear population has been moderate in density and stable in number. Highest densities are found in the Kilbuck Mountains southeast of Bethel and in the Andreafsky Mountains and Nulato Hills north of the Yukon River.

Average annual harvests have varied markedly, although the harvests have recently declined. The reported harvest from 1970 to 1978 averaged 1.3 bears per year and increased to 15.1 bears per year from 1979 to 1986. The highest reported harvest was 24 bears in 1981. Only 5 bears were reported taken in 1987, and two were reported taken in 1988.

The unreported harvest may be substantial, exceeding in magnitude the annual reported harvest. Many bears taken for subsistence purposes and in defense of life and property (DLP) are not reported. Most of the subsistence harvest is apparently confined to the Kilbuck Mountains, averaging a minimum of 5 to 11 bears annually.

POPULATION OBJECTIVES

To maintain the existing brown bear population (i.e., 400-700).

To improve the quality of our harvest data.

METHODS

Observations of bears were incidentally made by Department and U.S. Fish and Wildlife Service (USFWS) personnel during aerial and ground surveys directed at other species. Informal reports from the public and interviews of local residents concerning bear distribution and unreported harvests were compiled. Information from sealing-certificate records were analyzed to determine the location and sex and age composition of bears reported taken during the year.

RESULTS AND DISCUSSION

Population Status and Trend

The brown bear population in Unit 18 appears moderately high in number and stable in suitable montane and riparian habitat.

Population Size:

A census has never been conducted on bears in Unit 18. Although quantitative data were lacking, the brown bear population numbers approximately 400 to 700 (Machida 1986). Accurate assessment of brown bear populations, however, awaits comprehensive research and collection of population data.

Distribution and Movements:

Salmon-spawning streams such as the Kisaralik and Kwethluk Rivers in the Kilbuck Mountains and the Andreafsky River north of Saint Marys support greater brown bear densities than are found elsewhere in the unit. The forested riparian corridors of the Yukon River and tributaries of the Kuskokwim in Unit 18 support lower but moderate densities of brown bears. The vast treeless lowland of the Yukon-Kuskokwim Delta contains very few bears, although dispersal undoubtedly occurs through riparian and deltaic habitats. Bears have occasionally been sighted along the west coast of Unit 18 in the Askinuk Mountains and on Nelson Island. The number of reported observations of brown bears on Nelson Island has been increasing in recent years. During the fall of 1988, 4 or 5 bears were observed on Nelson Island, including a sow with 2 cubs. Apparently, 1 bear denned on the Island during the 1988-89 winter.

Mortality

Season and Bag Limit:

The open seasons for subsistence hunters in Unit 18 are 10 April to 25 May and 10 September to 10 October. The open seasons for residents and nonresidents are 10 to 25 May and 10 September to 10 October. The bag limit for all hunters is 1 bear every 4 regulatory years.

Human-induced Harvest:

The reported harvest increased sharply after guides began operating in Unit 18 in 1979. The record reported harvest was 24 brown bears in 1981; however, the reported harvest began to decline in 1986 because of a decrease in guiding activity. The reported harvest of 5 bears each in 1986 and 1987 represented a marked decrease from those previously observed. The trend continued in 1988, and only 2 bears were reported harvested. One bear, a large adult male, was harvested during May 1988 by a guided nonresident in the upper Kwethluk River drainage during a 10-day hunt. The second bear, an adult female, was taken by a local resident during September 1988 on an island in the Yukon River near the village of Pilot Station.

A subsistence brown bear harvest is conducted annually in the spring by several families in the upper Kwethluk River drainage.

Their harvests average 5 to 11 bears annually. This subsistence harvest is usually not formally reported because of the reluctance of many local residents to provide written documentation of their activities, although they freely provide the information if interviewed. Although some bears are undoubtedly taken in other areas by subsistence hunters, the numbers are believed to be low. Most of the harvest has occurred during the spring. Locally intensive brown bear subsistence harvests have occurred approximately once every 10 years by lower Kuskokwim Bay villagers, when shorefast ice has hindered seal hunting and snow conditions facilitated spring bear harvest by snowmachines. As many as 20 bears were taken in the vicinity of Goodnews Bay in 1985. The number of DLP mortalities each year is not known with certainty, because such harvests are usually not reported.

If we assume 5% of the population can be safely harvested ea year, Unit 18 should produce an annual harvestable surplus of to 35 bears. The harvest levels of brown bears in Unit 18 appe not to have exceeded sustained yield, although it could hav occurred in 1981 and 1985. Because the actual size and productivity of the bear population is unknown and the magnitude of the unreported harvest substantial, it is difficult to ascertain whether harvests were indeed excessive.

Transport Methods. The nonresident hunter who harvested a bear in the Kwethluk drainage in spring 1988 used an aircraft for transportation. Resident and subsistence hunters have used snowmachines, boats, and occasionally aircraft for transportation. These patterns are typical and have changed little during the past 6 years.

Habitat Assessment

Unit 18 contains approximately 11,000 mi^2 of fair-to-excellent quality brown bear habitat in the Kilbuck and Andreafsky Mountains. Additional lowland riparian habitats, surrounded by tundra, support moderate densities of brown bears along the Yukon River and tributaries of the Kuskokwim River. Although quantitative data are lacking, the lowland riparian habitats along the Yukon River appear to be highly productive.

The size of the brown bear population in Unit 18 is at carrying capacity. Most brown bear habitat is protected by the Yukon Delta National Wildlife Refuge, and land status is not expected to change in the near future.

CONCLUSIONS AND RECOMMENDATIONS

Brown bears are moderate in density and stable in number in Unit 18. Average annual harvests, which have varied markedly, are dependent upon spring weather, snow cover, and levels of nonresident and subsistence hunting. Record harvests have been

the 24 brown bears reported in 1981 and a documented 1985 subsistence harvest of at least 20.

Habitat for brown bears includes both montane and lowland riparian areas. The montane habitats appear excellent for brown bears. The bear population in lowland riparian corridors, particularly along the Yukon River, may be substantial; however, quantitative evidence is lacking.

The utility of harvest data would be enhanced if actual population size, density, and distribution were more fully understood. During past years, brown bear research in Unit 18 has been rated low in priority because of budget and manpower restraints. However, local residents have recently requested additional opportunities to hunt bears for subsistence from the Board of Game . A comprehensive brown bear population study is strongly recommended, at least for the Kilbuck Mountains where most of the subsistence and recreational harvests have occurred.

LITERATURE CITED

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STUDY AREA

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

GEOGRAPHICAL DESCRIPTION: Drainages of the Middle Fork and upper Kuskokwim River upstream from the village of Kalskag

BACKGROUND

Although brown bears appear to be distributed throughout Unit 19, the level of sport harvest in the area has been low to moderate. Following relatively low harvests throughout the 1960's (1961-1970 annual mean harvest = 15.2), an increase occurred in the 1970's (1971-1980 mean annual harvest = 53.7). From 1981 to 1987, reported harvests have been moderate, compared with the earlier 2 decades (1981-1987 mean annual harvest = 28.1; Fig. 1). Subunits 19B and 19C have produced the majority of the harvest, and Subunits 19A and 19D have provided lower annual harvests.

In the higher elevations within the Alaska Range (i.e., Subunits 19B and 19C) and Kuskokwim Mountains where guides are operating, there has been moderate harvest pressure. There are undoubtedly unreported incidental harvests of brown bears in lower-elevation areas within Subunits 19A and 19D, especially around villages and fish camps; however, the documented take has been extremely light.

MANAGEMENT OBJECTIVES

To provide a mean annual harvest of 30 brown bears with a minimum of 50% males in the harvest.

To reduce human-bear conflicts during closed seasons by increasing legal harvests of brown bears in and around villages, fish camps, and other human habitations during open seasons

METHODS

No surveys have been conducted in Unit 19. Harvest trends (based on sealing documents) are reviewed annually, and regulations may be amended when harvest data indicate the need.

RESULTS AND DISCUSSION

Population Status and Trend

From analyses of harvest data it appears that the present population is moderately abundant. Assuming that Pegau's (1987) estimate of 900 brown bears is reasonable, the 1987 reported

harvest of 36 represents about 4% of the population. At that level, it probably will not cause a decline in the population. I suspect other factors, in addition to harvest, have combined to keep brown bear populations in Unit 19 at relatively stable levels.

During the 19-year period from 1969 to 1987, 736 brown bears (for which days of effort were listed) were reported harvested from Unit 19. Successful hunters spent an average 5.5 days to harvest a bear (n = 736). During the 1988 seasons, 34 hunters averaged 7.5 days (n = 34) days afield before harvesting a bear (Table 1). This number is not significantly different from those of previous years, perhaps lending further credence to the hypothesis that bear populations are relatively stable.

Population Size:

With about 37,000 mi^2 in the area, an overall density of 1 bear/41 mi^2 is indicated. Subunit 19B probably contains the best habitat; densities there were estimated at 1 bear/25 mi^2, for a total of about 300 bears. Subunit 19C has about 5,200 mi^2 of good habitat (1 bear/25 mi^2 = 210 bears) and about 1,500 mi^2 of poor habitat (1 bear/50 mi^2 = 30 bears). Subunit 19D generally contains poor habitat (1 bear/75 mi^2 = 165 bears). Subunit 19A has habitat which probably contains about 1 bear/50 mi^2, for a total of about 200 bears.

Distribution and Movements:

Although no formal surveys have been conducted in the unit, it appears that brown bears are distributed widely. As mentioned above, Subunit 19B and portions of Subunit 19C probably contain the best habitat and thus higher densities.

Mortality

Seasons and Bag Limits:

The open seasons are 10-25 May and 1 September to 10 October. The bag limit is 1 brown bear every 4 years. The harvest of cubs or females accompanied by cubs is prohibited.

Human-induced Mortality:

The 1988 reported harvest of 34 bears indicates no substantial change in harvest trend from the mean annual 1981-87 mean of 28.1 bears. Harvests by subunit were also typical: 27 of 33 (82%) known harvest locations were from Subunits 19B and 19C.

Estimated illegal and unreported harvests are difficult to enumerate; however, they may be as high as 20-30% of the reported harvest. Problems with brown bears at villages and fish camps often lead to DLP mortalities; however hides and skulls are not

salvaged, and the take remains undocumented. The majority of the undocumented harvest probably occurs in Subunits 19A and 19D.

Hunter Residency and Success. During the period 1961 through 1987, 886 brown bears were reported harvested from Unit 19 (Table 2). Of those, 709 (80%) were taken by nonresidents (Table 3), indicating a very active guiding industry in the unit. During 1988, 31 of 34 bears (94%) were taken by nonresidents, the highest percentage taken by nonresidents since record keeping began in 1961.

Success rates of bear hunters in Unit 19 are unknown. Harvest data are based on hide and skull sealing documents; there are no provisions for documentation of unsuccessful hunters.

Harvest Chronology. Most (84%) of the brown bears taken in Unit 19 during the period 1961 to 1987 were harvested during the fall seasons. A 15-day spring season was open during mid-May, but it appears few hunters took advantage of it. During 1988, 7 bears were harvested in May (21% of the total 1988 harvest); the remainder were taken in September and October (Table 4). This is not significantly different from the harvest chronology during the previous 10-year period.

Transport Methods. Because no roads enter Unit 19 from other areas, the majority of the brown bear harvest is facilitated through air transportation. During the period 1969 to 1987, 644 of 739 (87%) successful hunters reached the area by air. In 1988, 29 of 33 (88%) successful hunters used airplanes to reach hunting areas, consistent with earlier percentages. The method of transportation has remained relatively consistent since 1969, when the method of transport was first indicated on sealing documents (Table 5).

Age of Harvested Bears. Of 32 bears harvested during 1988 whose ages were determined through cementum annuli counts, mean age was calculated to be 6.93 $\pm$ 1.43 years (Student's T-test = 0.05) (Table 6, Figs. 2 and 3). Although not statistically significant, the trend since 1980 appears to be an increase in the mean age of harvested bears.

Sex Ratio in the Harvest. With the present low harvest levels, population impacts from hunting are apparently negligible. At such low levels, annual sex ratios of harvested bears can be expected to fluctuate. Although the proportion of males in the harvest has generally been near 60% (Table 7), it has fluctuated from a low of 29% (1966) to a high of 77% (1971) during the 28-year period from 1961 to 1988. The preponderance of males in the harvest reflects a healthy population. I think that many brown bear hunters in Unit 19 are taking bears on multispecies hunts and are not necessarily attempting to harvest record-class specimens; therefore, the harvest of females (except those with cubs or yearlings) is unavoidable. Until brown bear hunting effort becomes more intense in Unit 19, I feel that a management

scheme designed to harvest greater than 50% males should afford the needed protection.

Habitat Assessment and Enhancement

As reflected in the locations of the majority of the harvests (Table 2), the upland areas of Subunits 19B and 19C probably provide the best bear habitat in the unit. No studies have been undertaken to assess the suitability of the habitat to support bears in Unit 19.

Game Board Actions and Emergency Orders

No changes in spring season lengths have occurred in the past 5 years. However, during spring 1983 and 1984, Subunit 19B brown bear hunting was by drawing permit only, with 9 spring permits issued during each of those 2 years. Fall seasons have remained the same in subunit 19B during the period 1983-87.

From 1983 to 1986, the fall season in Subunits 19A, 19C, and 19D was 10 September-10 October (30 days), but it was lengthened to 40 days in 1987; currently, it runs from 1 September to 10 October. This 10-day increase over the previous seasons may be at least partially responsible for the increased harvest (i.e., from 25 in 1986 to 36 and 34 in 1987 and 1988, respectively).

I believe the current regulations adequately protect the brown bear population, while still allowing a modest harvest. Because of chronically low harvests of brown bears in Subunit 19D, I have proposed a change in the seasons to the McGrath Fish and Game Advisory Committee. That proposed change, to be presented to the Alaska Board of Game in the spring of 1990, would move the spring season dates to 15-31 May. Currently, breakup of major rivers in the area occurs around 15 May, and the 10-25 May season dates make it difficult to hunt bears because of poor access opportunities. I believe the later season dates will make access by boat less hazardous and may serve to increase the hunting opportunities.

CONCLUSIONS AND RECOMMENDATIONS

I recommend that present regulations be continued. Current seasons and bag limits have allowed only a modest harvest, and the mean annual ages and sex ratios of harvested bears do not indicate declines in the population. Brown bear predation on moose and caribou is not an apparent widespread problem in the unit. By continuing current regulations, I would suspect that future harvests will continue to be between 30 and 50 bears annually.

Annual review of sealing certificate data will continue. If sex ratios in the harvest begin to favor females, changes in seasons may be indicated. Mean ages of harvested bears has fluctuated

annually, but it appears that the older-age component of the population has remained intact.

Personal contacts in villages and fish camps by ADF&G and Fish and Wildlife Protection personnel will continue to stress the need for documentation of harvests, whether they are sport-harvested or DLP bears. Because of the regulation requiring a $25 resident tag, compliance by local residents is low. Perhaps allowing state residents to harvest a bear and then retroactively obtaining the necessary tag would increase reporting.

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Figure 1. Annual reported harvest of brown bears from Game Management Unit 19 from 1961 to 1988.

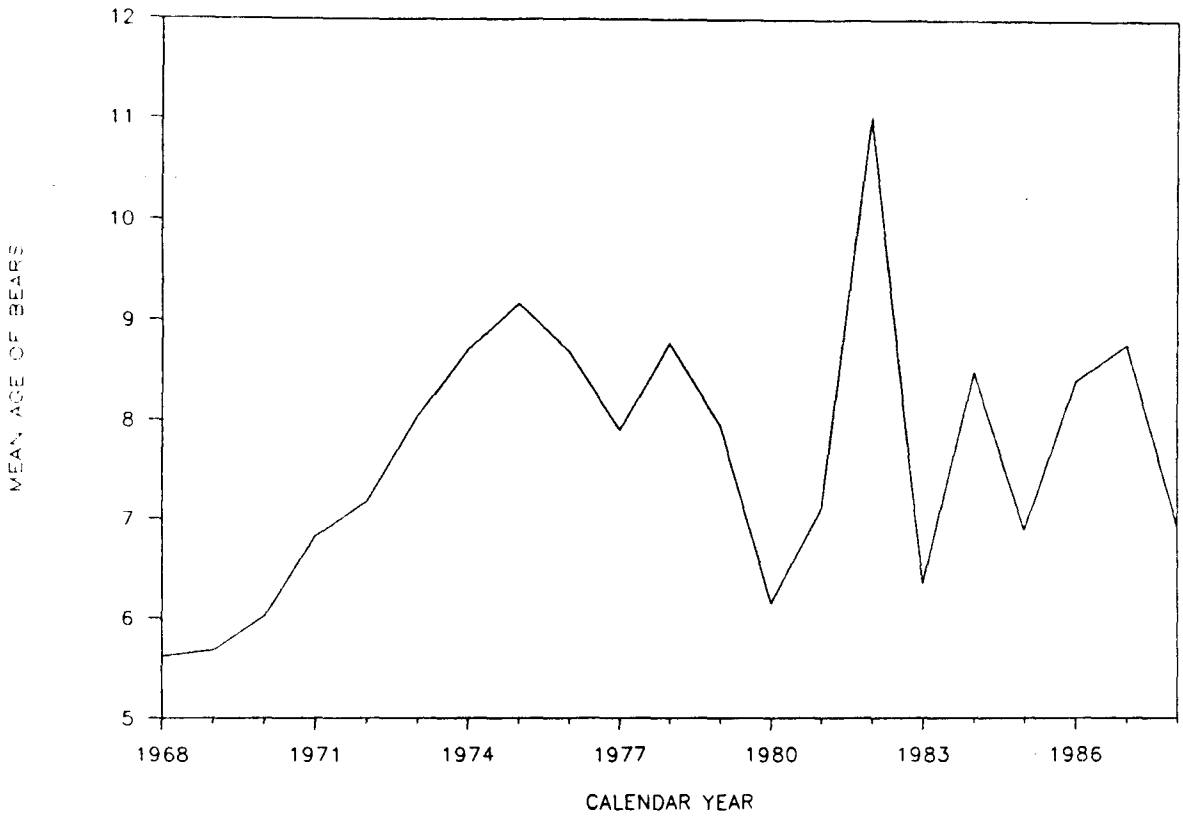

Figure 2. Mean ages of harvested brown bears from Game Management Unit 19 from 1968 to 1988.

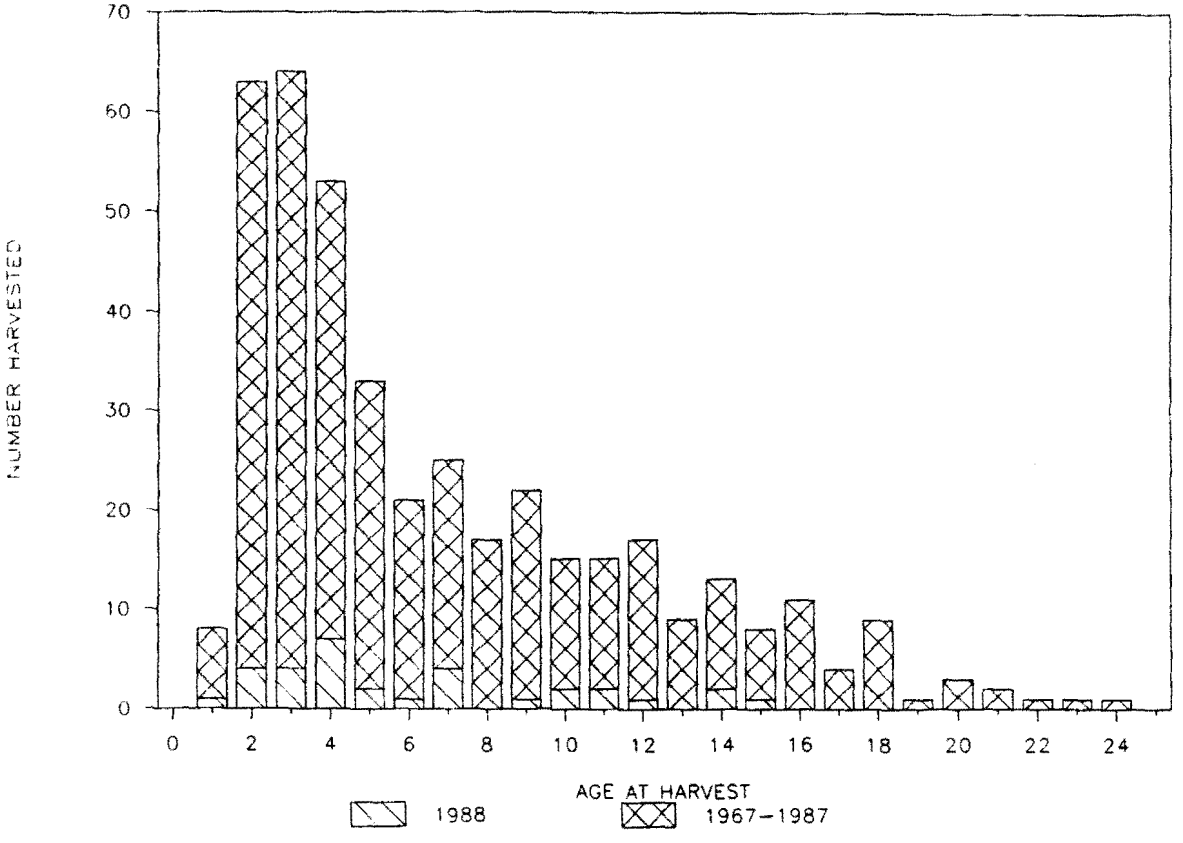

Figure 3. Age frequency distribution of harvested brown bears from Game Management Unit 19 from 1967 to 1988.

Table 1. Annual hunter effort by successful brown bear hunters in Unit 19, 1969-88.

Year hunted	Number of hunters	Mean days
1969	11	6.18
1970	19	8.89
1971	26	5.04
1972	45	4.82
1973	62	4.63
1974	57	5.86
1975	38	4.82
1976	46	5.28
1977	43	5.86
1978	71	4.63
1979	66	5.27
1980	57	5.61
1981	38	5.29
1982	19	5.16
1983	34	5.94
1984	19	5.68
1985	24	7.88
1986	25	6.96
1987	36	5.17
1988	34	7.50
Total	770	5.58

Table 2. Annual harvest of brown bears in Management Unit 19, 1961-88.

Year	Game Management Subunit					Total
	A	B	C	D	Z	
1961	-	1	12	-	-	13
1962	1	3	8	1	-	13
1963	-	1	7	2	-	10
1964	-	3	15	1	-	19
1965	-	2	15	-	-	17
1966	-	1	16	-	-	17
1967	-	-	13	1	-	14
1968	-	2	11	1	-	14
1969	1	-	10	2	-	13
1970	-	2	20	-	-	22
1971	1	7	21	-	-	29
1972	1	17	25	3	-	46
1973	5	27	30	1	-	63
1974	6	21	32	-	-	59
1975	2	17	24	-	-	43
1976	2	27	26	1	-	56
1977	4	20	22	-	-	46
1978	5	41	24	1	-	71
1979	18	27	20	2	-	67
1980	7	31	17	2	-	57
1981	2	4	26	6	-	38
1982	3	3	10	4	-	20
1983	8	5	20	2	-	35
1984	-	6	11	2	-	19
1985	6	11	5	2	-	24
1986	5	12	7	1	-	25
1987	4	16	13	3	-	36
1988	5	11	16	1	1	34
Totals	86	318	476	39	1	920

Table 3. Residency status of successful brown bear hunters in Unit 19, 1961-88.

Year	Residents	Nonresidents	Unknown	% Nonresidents
1961	4	9		69
1962	9	4		31
1963	3	7		70
1964	7	12		63
1965	3	14		82
1966	3	14		82
1967	4	10		71
1968	4	10		71
1969	4	9		69
1970	6	16		73
1971	7	21	1	72
1972	14	32		70
1973	14	48	1	76
1974	8	51		86
1975	4	39		91
1976	9	47		84
1977	6	40		87
1978	7	64		90
1979	12	55		82
1980	3	53	1	93
1981	6	32		84
1982	3	16	1	80
1983	5	30		86
1984	6	13		68
1985	7	17		71
1986	7	18		72
1987	8	28		78
1988	2	31	1	94
Totals	175	740	5	80

Table 4. Chronology of the harvest of brown bears from Unit 19, 1961-88.

Year	Month of harvest							Total harvest	% in spring
	5	6	7	8	9	10	11		
1961					8	5		13	0
1962	1				8	1	3	13	8
1963					9	1		10	0
1964			1		16		2	19	0
1965		1			16			17	6
1966	1				15	1		17	6
1967	1				12		1	14	7
1968	1				11	2		14	7
1969	1	1		1	10			13	15
1970	2			1	19			22	9
1971	5	4	1		13	5	1	29	31
1972	4	4			34	3	1	46	17
1973	3	3			54	3		63	10
1974	6	7			39	7		59	22
1975	4				29	10		43	9
1976	2				44	10		56	4
1977	10				27	9		46	22
1978	13				50	8		71	18
1979	17				46	4		67	25
1980	11				35	11		57	19
1981	9				19	10		38	24
1982	2				15	3		20	10
1983	6				26	3		35	17
1984	2				14	3		19	11
1985	6				14	4		24	25
1986	5				16	4		25	20
1987	6				27	3		36	17
1988	7				25	2		34	21
Total	125	20	2	2	651	112	8	920	16

Table 5. Reported method of transportation used by brown bear hunters in Unit 19, 1969-88.

	Method of transportation							
Year	Air	Horse	Boat	3-wheeler	Snow-machine	Offroad vehicle	Highway	Total
1969	11	-	-	-	-	1	-	12
1970	10	1	-	-	-	10	-	21
1971	18	-	1	-	-	7	-	26
1972	37	5	1	-	-	2	-	45
1973	52	-	1	-	-	9	-	62
1974	52	1	-	-	-	5	-	58
1975	35	1	-	-	-	-	3	39
1976	37	1	1	-	-	1	6	46
1977	44	1	-	-	-	-	-	45
1978	63	2	2	-	1	1	2	71
1979	64	2	-	-	-	-	1	67
1980	54	2	-	-	-	-	-	56
1981	31	2	3	1	-	-	-	37
1982	18	-	1	-	-	-	-	19
1983	30	-	2	1	-	-	-	33
1984	17	-	1	1	-	-	-	19
1985	21	-	2	-	1	-	-	24
1986	22	1	-	-	1	-	-	24
1987	28	2	4	1	-	-	-	35
1988	29	-	-	3	-	-	1	33
Total	673	21	19	7	3	36	13	762

Table 6. Mean ages of brown bears harvested annually from Game Management Unit 19, 1968-88.

Year	Mean age	n	SE = 0.05
1968	5.62	11	1.91
1969	5.68	12	3.37
1970	6.02	19	1.92
1971	6.82	24	1.86
1972	7.17	43	1.45
1973	8.04	60	1.56
1974	8.71	56	1.41
1975	9.16	43	1.52
1976	8.69	51	1.41
1977	7.90	44	1.36
1978	8.77	69	1.36
1979	7.94	66	1.23
1980	6.15	56	1.01
1981	7.09	37	1.47
1982	11.02	19	3.46
1983	6.35	34	1.77
1984	8.49	19	2.14
1985	6.89	23	2.09
1986	8.40	25	2.01
1987	8.76	35	2.02
1988	6.93	32	1.43

Table 7. Reported sex of harvested brown bears from Unit 19, 1961-88.

Year	No. males	No. females	No. unkown	% males
1961	6	6	1	50
1962	8	5	-	62
1963	5	4	1	56
1964	10	8	1	56
1965	6	11	-	35
1966	5	12	-	29
1967	6	7	1	46
1968	6	5	3	55
1969	9	3	1	75
1970	13	6	3	68
1971	20	6	3	77
1972	27	15	4	64
1973	42	18	3	70
1974	40	17	2	70
1975	24	17	2	59
1976	29	23	4	56
1977	22	24	-	48
1978	35	35	1	50
1979	44	21	2	68
1980	30	24	3	56
1981	21	15	2	58
1982	13	6	1	68
1983	19	16	1	54
1984	9	7	3	56
1985	10	14	-	42
1986	17	6	2	74
1987	23	12	1	66
1988	22	11	1	67
Totals	521	354	46	60

STUDY AREA

GAME MANAGEMENT UNIT: 20A, 20B, 20C, and 20F (34,000 mi^2) and 25C (5,250 mi^2)

GEOGRAPHICAL DESCRIPTION: Tanana Valley, Central Alaska Range, White Mountains, Tanana Hills

BACKGROUND

Grizzly bears occur throughout the study area. Low grizzly bear densities are found in low-elevation, spruce-dominant, or mixed forests. Moderate densities are found in foothill or mountainous terrain near and above treeline. Grizzly bears have been shown to be a significant predator of moose in Unit 13 and Subunit 20E (Boertje et al. 1987). It is likely that they also impact moose and caribou populations; however, their predation rates have not been investigated.

A 10-year grizzly bear study to relate changes in harvest rate to population dynamics was begun in the central Alaska Range (Subunit 20A) in 1981 (Reynolds and Hechtel 1987). Prior to 1981 harvest rates in the central Alaska Range were estimated to be below 3% of that portion of the population older than 2 years of age. The study is now focusing on the population's response to hunting when harvest rates are greater than 10% annually. Therefore, the management objective in Subunit 20A calls for maintaining a high rate of exploitation. Grizzly bear populations in Subunits 20B, 20C, 20F, and 25C have been stable.

Management of grizzly bears is ultimately guided by the Alaska Constitutional directive that states, "Fish, forests, wildlife, grasslands, and all other replenishable resources belonging to the state shall be utilized, developed, and maintained on the sustained yield principle, subject to preferences among beneficial uses." The following management goals reflect broad management policies that we feel will meet that constitutional mandate. The management objectives reflect the biological parameters we feel will best meet those management goals, given our current understanding of grizzly population dynamics.

MANAGEMENT OBJECTIVES

To manage harvests to sustain a mean annual exploitation rate of 10-15% of the estimated grizzly population older than 2 years of age until 1992 in Subunit 20A.

To provide a stable population with a mean annual harvest of no more than 8 grizzly bears and an average of at least 55% males in the harvest in Subunit 20B east.

To maintain a closed season on grizzly bears within Denali National Park and encourage efforts by the National Park Service to develop visitor guidelines and garbage disposal practices that reduce the potential for human-grizzly conflicts in that portion of Subunit 20B within Denali National Park.

To provide stable populations with a combined mean annual harvest of up to 30 grizzly bears in Subunits 20B west, 20C, 20F, and 25C. The average annual harvest from any of these individual subunits should not exceed 10 bears.

METHODS

Harvest data were collected by sealing sport-killed grizzly bears. Most bears were sealed in the ADF&G office in Fairbanks, but some were sealed in other ADF&G offices. There are no authorized private-sector bear sealers in the Fairbanks area. Methods for estimating population densities in the central Alaska Range of Subunit 20A were described by Reynolds and Hechtel (1987).

RESULTS AND DISCUSSION

Population Status and Trend

Grizzly bear numbers are thought to be stable in the study area, except in the Alaska Range portion of Subunit 20A where bear numbers are slowly declining because of the high harvests maintained for research purposes (Reynolds and Hechtel 1987).

Population Size:

Only 2 recent estimates are available for grizzly bear densities in Interior Alaska. In a their 1,500-mi^2 study area in Subunit 20A, Reynolds and Hechtel (1987) estimated spring adult ($\geq$2 years of age) densities at 2.7 bears/100 mi^2. Similarly, Boertje et al. (1987) estimated a spring density of slightly less than 3.0 adult grizzly bears/100 mi^2 in a 1,550-mi^2 study area in Subunit 20E. Based on harvest reports and hunter sightings of grizzly bears at bait stations (i.e., for black bears), densities in Subunits 20B, 20C, 20F, and 25C were lower than those in Subunits 20A or 20E.

Population Composition:

Reynolds and Hechtel (1987) reported a population of 29 males and 29 females in their Alaska Range study area (1,500 mi^2) in Subunit 20A. The adult population contained 18 males and 22 females, 7% of the population were cubs of the year, and 32% of the population were cubs >3 years of age. The mean ages of adult bears were 10.2 and 11.5 years for males and females,

respectively. The median ages for adult males and females were 7.5 and 11.0 years, respectively.

Of the 17 litters of cubs of the year since 1981, the mean litter size has been 2.1. Of 10 litters weaned as 2- or 3-year-olds, the mean litter size was 2.0. Rather than reflecting high survival of cubs, the similarity in mean litter sizes between cubs of the year and weaned cubs reflects a pattern of total mortality for some litters and complete survival for others (Reynolds and Hechtel 1987).

Distribution and Movements:

Mean home range sizes from 1982 to 1985 in the Alaska Range study area were 400 mi^2 for adult males ($\underline{n}$ = 5) and 90 mi^2 for adult females ($\underline{n}$ = 18) (Reynolds and Hechtel 1986). Female subadults had a tendency to remain near the maternal home range after weaning, and subadult males more often moved away from the maternal home range.

Mortality

Season and Bag Limit:

In Subunits 20A, 20B, 20C, 20F, and 25C, the open season is from 1 April to 31 May and 1 September to 30 November. The bag limit is 1 bear every 4 years. Hunting cubs or females accompanied by cubs is prohibited.

Human-induced Mortality:

In the entire study area during 1988, hunters reported taking 26 grizzly bears: 18 males, and 8 females (Table 1). No bears were reported taken in defense of life or property (Table 2).

The 1988 harvest of 26 grizzly bears was well below the 5-year average (1983-87) annual harvest of 37 bears (Table 3). Harvests in Subunits 20A and 20B were nearly 50% below the previous 5-year average. Fall harvests were similar to those for previous years, but only 3 grizzly bears were harvested during the spring season: two in Subunit 20C and one in Subunit 20F.

In recent years grizzly bears in Subunit 20A and the eastern portion of Subunit 20B have been subjected to the greatest hunting pressure within the study area. From 1984 to 1988, 46% of the total harvest (including DLP's) came from the mountains of Subunit 20A and 20% from eastern Subunit 20B. The harvest rate in the Alaska Range portion of Subunit 20A was sufficient to continue a population decline that began in the early 1980's (Reynolds and Hechtel 1987). That harvest rate was estimated by Reynolds and Hechtel (1987) to be 12.5-13.4% of the adult grizzly population ($\geq$2 years of age) in their study area for the years 1981 to 1986.

By applying the Reynolds and Hechtel (1987) density estimate (2-7 adult bears/100 mi^2) to adjacent areas in Subunit 20A that contain similar mountainous habitat, I calculated 5-year mean harvest rates of 33% and 13% for the Yanert Controlled Use Area (YCUA) and western foothills, respectively (Table 4). Applying the density estimate to the entire mountain-foothill region (3,582 mi^2) of Subunit 20A resulted in a calculated harvest rate of 14% for the years 1984 to 1988.

The high harvest rate in the YCUA has resulted in a low mean age and percentage of males in the harvest. From 1984 through 1988, 26 grizzly bears were reported taken in the YCUA (i.e., 575 mi^2). Specific harvest locations were available for 20 of these bears, and 15 of the 20 were taken in a 180-mi^2 area near the Parks Highway (i.e., Moose, Revine, and Carlo Creek drainages). I believe that level of harvest is entirely dependent upon young bears dispersing from Denali National Park that lies adjacent to the YCUA east of the highway and from the upper Yanert River drainage that remains lightly hunted. Because the harvest is localized by access restrictions, I do not feel it currently threatens the overall grizzly bear population in Subunit 20A or that subpopulation in the upper Yanert River drainage.

If grizzly bear densities in eastern Subunit 20B were equal to those in the mountains of Subunit 20A, then the mean reported harvest and DLP mortality in eastern 20B (4,500 mi^2) during the period 1984to 1988 (i.e., 7.0 bears/year) was approximately 6% of the adult population. However, habitat differences, hunter reports, and general observations suggest that because grizzly bear densities were lower in eastern Subunit 20B, the harvest rates were higher. For management purposes, I consider the average harvests in eastern Subunit 20B to be near the maximum allowable for maintaining a stable grizzly bear population.

Subunits 20B west, 20C, 20F, and 25C cover 71% of the study area but support only 31% of the harvest. Grizzly bear densities in some portions of those subunits are probably equal to those in eastern Subunit 20B. Therefore harvests in Subunits 20B west, 20C, 20F, and 25C are well below maximum sustainable levels, and the stability or growth of the population is dependent on other natural regulatory factors, such as habitat and food availability.

The difference in harvest rates between the mountains of Subunit 20A and the remainder of the study area were reflected in the mean age and proportion of males in the harvest (Table 5). The mean age of all males taken between 1984 and 1988 in the Alaska Range portion of Subunit 20A was 4.5 years (n = 37). In the remainder of the study area, the mean age of harvested males was 7.0 years (n = 51). Similarly, the mean age of females harvested in the Alaska Range portion of Subunit 20A between 1984 and 1988 was 5.3 years (n = 36). The mean age of female bears harvested in the remainder of the study area was substantially higher ($\bar{x}$ = 9.4 years, n = 27). The percentage of males in the 1984 to 1988

harvests was also lower in the Alaska Range (48%) than in the remainder of the study area (66%).

Although interpretation of declining mean ages in the harvest is not always straightforward (Table 6), the results suggest the mean age and percentage of males in the harvest may be indicators of low or high exploitation rates, given sufficient sample sizes over time. Similar interpretation of changes observed among small annual harvests is probably unreliable.

Hunter Residency and Success. Since 1984 most successful grizzly bear hunters in the study area have been local residents ($\bar{x}$ = 54%). Annual averages of 14% and 23% of these successful hunters were military and nonresidents, respectively. A breakdown of successful hunters by residency is given in Table 7.

Harvest Chronology. Fall grizzly bear harvests generally are larger than spring harvests, because many bears are incidently taken by moose, caribou, or sheep hunters. Since 1984 an average of 76% of the annual harvest was taken during fall (Table 8).

Transport Methods. Successful grizzly bear hunters have not substantially changed transport use during the last 5 years (Table 9). Aircraft provided the most popular means of access, accommodating an average of 36% of the successful hunters since 1984.

Natural Mortality:

During the period 1981 to 1986, natural mortality rates for young bears under maternal care within the study population in Subunit 20A were 36% for cubs, 12% for yearlings, and 7% for 2-year-olds (Reynolds and Hechtel 1987). Natural mortality was 3% among radio-collared females (n = 28) aged 2 to 25 years. Cannibalism by adult males was suspected as the primary cause of mortality among young bears accompanied by their mothers.

Habitat

A proposal for a significant increase in mining operations in the Beaver Creek and Birch Creek drainages of Subunit 25C creates the potential for increased human-bear conflicts. Construction of access roads and mining camps and alteration of riparian habitats will probably be detrimental to grizzly bears.

Game Board Actions and Emergency Orders

During the last 5 years the spring grizzly season has been 1 April to 31 May; the fall season has varied among the subunits. Sealing and tag requirements have remained the same. No Emergency Orders have been issued for grizzly bears in the study area during the last 5 years.

CONCLUSIONS AND RECOMMENDATIONS

There are 3 different "harvest zones" within the area included in Subunits 20A, 20B, 20C, 20F, and 25C. Relatively high harvest rates in Subunit 20A have been accompanied by a population decline (Reynolds and Hechtel 1987). Although harvests in the eastern portion of Subunit 20B have been less than those in Subunit 20A, they may be near the maximum sustainable. Harvests in the remainder of the study area were below maximum sustainable yield.

Because differing harvest rates were recognized in development of management and harvest objectives, management plans will be designed to allow independent regulation of harvests in each zone. Harvest criteria (e.g., mean age, percentages of males) were established to help decide if harvests were meeting or exceeding management goals; however, sex and age data can be highly variable from year to year when sample sizes are small. I recommend management decisions be based on 3-year averages.

During the last 3 years (1986-1988), grizzly bear harvests met the management criteria outlined in the management objectives. Harvests in the mountains of Subunit 20A averaged approximately 15% of the estimated adult grizzly bear population. Harvests in Subunit 20B east averaged less than 4 bears per year with 69% males in the harvest, and harvests in the remainder of the study area averaged 1 bear annually with 67% males in the harvest (Table 10).

There have been public proposals to delete the $25 tag fee in Subunit 20A; I recommend it be maintained. Moose and caribou populations are not at low levels, and predation by grizzly bears has not caused a decline in moose or caribou population growth. I think waiving the tag fee would unnecessarily increase harvest on this heavily harvested population. No changes in season, bag limit, or tag fee requirements are recommended.

Management activities during the next regulatory year will include monitoring impact of expanded mining operations on grizzly bears in Subunit 25C; sealing of harvested bears; soliciting and compiling reports on grizzly bear distribution and abundance in Subunits 20B, 20C, 20F, and 25C where formal surveys have not been conducted; applying results of ongoing grizzly bear research to management.

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Table 1. Sex composition and seasonal distribution of grizzly bear harvest in Subunits 20A, 20B, 20C, 20F, and 25C, 1984-88[a].

	1984						1985						1986						1987						1988					
	Spring			Fall			Spring			Fall			Spring			Fall			Spring			Fall			Spring			Fall		
Subunit	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U
20A	3	3	0	9	9	2	0	0	0	2	5	0	5	3	0	9	7	0	3	2	0	8	7	0	0	0	0	4	6	0
20B	3	2	0	5	6	0	0	1	0	7	0	0	1	0	0	1	3	0	1	2	0	3	2	1	0	0	0	4	1	0
20C	0	0	0	4	0	0	0	0	0	2	1	0	1	2	0	0	2	0	2	0	0	3	0	0	2	0	0	3	0	0
20F	0	0	0	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
25C	0	0	0	0	2	1	2	1	0	0	0	0	0	0	0	0	2	0	1	1	0	0	1	0	1	0	0	3	1	0
Totals	6	5	0	19	18	3	2	2	0	13	6	0	7	5	0	10	14	0	7	5	0	15	10	1	3	0	0	15	8	0

[a] Includes bears killed in defense of life or property and research mortality.

Table 2. Distribution of bears killed in defense of life or property, Subunits 20A, 20B, 20C, 20F, and 25C, 1984-88.

Year	Subunit					Total
	20A	20B	20C	20F	25C	
1984	3	0	0	0	1	4
1985	0	3	0	0	0	3
1986	1	0	0	0	0	1
1987	2	2	1	0	1	6
1988	0	0	0	0	0	0

Table 3. Summary of annual grizzly harvest in Subunits 20A, 20B, 20C, 20F, and 25C, 1984-88.

Subunit	1984		1985		1986		1987		1988		5-year mean harvest
	Harvest	% Males	Harvest	% Males	Harvest	% Males	Harvest	% Males	Harvest	% Males	
20A	26	50	7	29	24	58	20	55	10	40	17.4
20B	16	50	8	88	5	40	9	50	5	80	8.6
20C	4	100	3	67	5	20	5	100	5	100	4.4
20F	2	50	2	100	0	--	1	100	1	100	1.2
25C	3	0	3	67	2	0	3	33	5	60	3.2
Total	50	52	23	65	36	47	38	58	26	69	34.8

Table 4. Distribution and composition of sport grizzly harvest in Subunit 20A, 1984-88.

Location	Uniform codes	Area (mi^2)	Total 5-year sport harvest		Est. harvest rate[a]	Mean age (yrs)	
			Males	Females		Males	Females
Western Foothills	(0102, 0105, 0202, 0302)	996	8	10	13%	4.6	4.5
Yanert Controlled Use Area	(0106-0109)	575	8	18	33%	3.4	4.4
Mountains from Wood River to Delta River	(0402-0405, 0505, 0602-0605 0702, 0802)	2,011	14	10	9%	5.2	7.4
Tanana Flats	(0101, 0201, 0301, 0401, 0501-0504, 0506, 0601, 0701, 0801)	3,169	10	2	-[b]	6.6	2.5

[a] Harvest rate calculated as mean annual harvest $\frac{\text{Area} \times 2.7}{100}$. Reynolds and Hechtel (1987) gave an estimated density of 2.7 bears/100 mi^2 (bears $\geq$2 years) in their Subunit 20A study area.

[b] Grizzly bear density on the Tanana Flats is unknown.

Table 5. Mean age and percentage males in the sport harvest summarized by areas with different harvest rates, Subunits 20A, 20B, 20C, 20F and 25C, 1984-88.

Year	Subunit 20A (mountains) Mean age Males (n)	Subunit 20A (mountains) Mean age Females (n)	Subunit 20A (mountains) % Males	Subunit 20B (east) Mean age Males (n)	Subunit 20B (east) Mean age Females (n)	Subunit 20B (east) % Males	Remainder of study area Subunit 20A (flats), 20B (west), 20C, 20F, and 25C Mean age Males (n)	Remainder of study area Subunit 20A (flats), 20B (west), 20C, 20F, and 25C Mean age Females (n)	Remainder of study area Subunit 20A (flats), 20B (west), 20C, 20F, and 25C % Males
1984	4.1(11)	6.3(11)	50	5.7(7)	9.6(7)	43	5.7 (6)	6.7(3)	72
1985	5.0 (2)	3.3 (3)	29	7.3(4)	11 (1)	80	6.7 (6)	9.5(2)	75
1986	4.8(11)	4.8(10)	55	5.0(2)	15.0(2)	40	11.3 (3)	7.2(6)	33
1987	4.4 (7)	7.0 (7)	47	9.7(3)	3.0(1)	50	8.2 (6)	11.3(3)	57
1988	5.0 (3)	3.3 (6)	33	7.3(3)	9.0(1)	80	5.8(10)	17.0(1)	92
1984-88 combined mean	4.5	5.3	48	6.8	9.4	61	7.1	9.4	71
SD	3.7	4.7		3.8	4.9		4.7	4.9	
n	34	36		19	13		32	14	

Table 6. Age and skull sizes[a] of sport-killed grizzly bears among 3 harvest zones in Interior Alaska, 1984-88.

20A Mountains						20B East[b]						Remainder 20A flats, 20B west, 20C, 20F and 25C							
Male			Females			Males			Females			Males				Females			
Age	Year	Skull	Age	Year	Skull	Age	Year	Skull	Age	Year	Skull	Age	Year	Skull	Unit	Age	Year	Skull	Unit
5	1984	20.4	9	1984	--	9	1984	24.1	1	1984	15.7	7	1984	--	20B	14	1984	21.4	20F
2	1984	--	2	1984	17.9	2	1984	20.8	11	1984	20.1	9	1984	21.8	20C	5	1984	20.1	25C
4	1984	19.5	12	1984	20.3	6	1984	23.8	9	1984	21.3	2	1984	--	20C	6	1985	20.6	20C
8	1984	22.5	--	1984	16.8	8	1984	20.9	11	1984	21.6	7	1984	24.7	20C	13	1985	21.1	25C
3	1984	17.8	10	1984	21.3	3	1984	18.0	2	1984	--	4	1984	21.0	20C	5	1986	19.6	20C
3	1984	19.3	2	1984	17.4	4	1984	17.6	10	1984	21.9	5	1984	21.0	20F	2	1986	14.6	20C
3	1984	18.9	4	1984	19.9	8	1984	24.3	15	1984	--	7	1985	19.4	20C	11	1986	20.0	25C
8	1984	25.4	3	1984	18.2	2	1985	19.0	9	1984	18.1	6	1985	22.8	20C	10	1986	21.3	25C
4	1984	20.4	4	1984	17.5	8	1985	22.0	11	1985	20	2	1985	16.3	20F	4	1986	--	20C
3	1984	20.6	17	1984	22.0	7	1985	23.1	12	1986	21.9	9	1985	24.8	20F	--	1986	21.0	20C
2	1984	16.6	3	1984	17.8	12	1985	25.4	18	1986	20.6	5	1985	21.6	25C	11	1986	20.5	20B
7	1985	23.5	3	1984	17.0	8	1986	24	3	1987	17.9	11	1985	24.1	25C	13	1987	20.5	25C
3	1985	19.5	--	1985	20.6	2	1986	18	9	1988	19.9	16	1986	23.1	20C	16	1987	20.5	20B
2	1986	--	3	1985	20.9	13	1987	24.8				3	1986	20.4	20A	5	1987	18.3	20B
4	1986	20.8	5	1985	19.8	13	1987	24.0				15	1986	23.8	20A	17	1988	20.3	25C
10	1986	24.8	2	1985	16.1	3	1987	--				4	1987	20.9	20A				
14	1986	23.9	2	1986	16.5	5	1988	24.5				3	1987	18.4	20C				
2	1986	16.2	8	1986	20.4	--	1988	25.9				13	1987	25.1	20C				
4	1986	20.1	2	1986	17.4	4	1988	20.4				3	1987	20.4	20C				
5	1986	20.6	3	1986	19.1	13	1988	24.4				13	1987	23.5	20C				
2	1986	18.5	6	1986	20.8							15	1987	23.8	20F				
1	1986	18.2	14	1986	20.5							12	1987	23.6	25C				
2	1986	18.7	2	1986	15.5							--	1987	25.0	20A				
7	1986	23.4	2	1986	17.9							--	1988	21.3	20A				
--	1987	23.9	2	1986	17.9							3	1988	19.6	20C				
3	1987	19.5	6	1987	21.6							2	1988	19.3	20C				
3	1987	19.5	6	1987	20.9							12	1988	22.9	20C				
2	1987	17.5	21	1987	22.1							4	1988	19.0	20C				
2	1987	18.3	2	1987	17.6							9	1988	24.8	20C				

Table 6. (Continued)

20A Mountains						20B East[b]						Remainder 20A flats, 20B west, 20C, 20F and 25C							
Male			Females			Males			Females			Males				Females			
Age	Year	Skull	Age	Year	Skull	Age	Year	Skull	Age	Year	Skull	Age	Year	Skull	Unit	Age	Year	Skull	Unit
2	1987	18.5	3	1987	19.4							1	1988	17.0	20F				
17	1987	24.0	9	1987	21.8							5	1988	22.7	25C				
2	1987	18.6	2	1987	17.9							16	1988	22.9	25C				
2	1988	19.1	10	1988	20.9							4	1988	19.3	25C				
3	1988	18.5	2	1988	17.1							2	1988	--	25C				
10	1988	23.7	3	1988	19.6														
			1	1988	15.8														
			2	1988	17.3														
			2	1988	17.3														
$\bar{x}$:																			
4.5		20.3	5.3		18.9	6.8		22.3	9.4		19.9	7.1		21.8		9.4		20.0	
SD:																			
3.7		2.5	4.7		1.9	3.8		2.6	4.9		2.0	4.7		2.4		4.9		1.7	
N:																			
34		33	36		37	19		21	13		11	32		31		14		14	

[a] Skull size in inches

[b] Subunit 20B east defined as that portion of 20B east of a line drawn north from Fairbanks through Haystack Mountain.

Table 7. Residency of successful grizzly bear hunters, sport kill only, Subunits 20A, 20B, 20C, 20F, and 25C, 1984-88.

Year	Military residents	Local residents[a]	Nonlocal residents	Nonresidents
1984	7	24	5	11
1985	3	8	1	7
1986	6	18	1	6
1987	5	17	4	7
1988	1	17	3	5

[a] Local resident defined as a hunter residing in Unit 20 or Subunit 25C, taking a bear anywhere in those subunits. Military personnel were not included in local residency category. Does not include bears killed in defense of life or property or research mortalities.

Table 8. Chronology of sport harvest for Subunits 20A, 20B, 20C, 20F, and 25C, combined, 1984-88.

Season	1984		1985		1986		1987		1988	
	M	F	M	F	M	F	M	F	M	F
Spring										
1 Apr-30 Apr	1	0	0	0	2	0	2	0	3	0
1 May-15 May	3	2	1	1	0	0	1	1	0	0
16 May-31 May	1	3	1	1	4	5	3	2	0	0
1 Jun-15 Jun	0	0	0	0	0	0	0	0	0	0
16 Jun-30 Jun	0	0	0	0	0	0	0	1	0	0
Total spring	5	5	2	2	6	5	6	4	3	0
Fall										
15 Aug-31 Aug	0	0	0	0	0	0	0	0	1	0
1 Sep-15 Sep	14	10	4	2	8	9	9	8	12	5
16 Sep-30 Sep	5	4	4	3	2	5	3	1	1	2
1 Oct-15 Oct	0	2	1	1	0	0	1	0	0	1
16 Oct-30 Oct	0	1	0	0	0	0	0	0	1	0
1 Nov-30 Nov	0		1	0	0	0	0	0	0	0
Total fall	19	17	10	6	10	14	13	9	15	8

Table 9. Transport methods of successful sport hunters, Subunits 20A, 20B, 20C, 20F, and 25C combined, 1984-88.

Year	Airplane	ORV	Boat	Horse	Other (3-wheeler, highway vehicle)
1984	15	7	6	5	13
1985	8	2	0	1	10
1986	14	4	3	5	9
1987	14	7	2	7	8
1988	8	3	3	4	8

Table 10. Distribution of sport grizzly harvests between the 3 study area "harvest zones" in Subunits 20A, 20B, 20C, 20F, and 25C during the past 3 years, 1986-88.

Area	Total 1986-88 sport harvest		Percent males
	Males	Females	
20A Mountains	22	22	50
20B East	9	4	69
Remainder of the study area (20A Flats, 20B west, 20C, 20F, and 25C)	22	11	67
Total study area	53	37	59

STUDY AREA

GAME MANAGEMENT UNIT: 20D (5,720 mi^2)

GEOGRAPHICAL DESCRIPTION: Central Tanana Valley near Delta Junction

BACKGROUND

Grizzly bears are distributed throughout Subunit 20D; however, little research has been done on them in this area. The harvests in the southern portion of the subunit have been moderate to high since 1961, but harvest north of the Tanana River have been low.

MANAGEMENT OBJECTIVES

To maintain a stable bear population in southern Subunit 20D and provide a mean annual harvest not to exceed 5% of the estimated population, including a minimum of 60% males.

To liberalize the season and bag limit in nothern Subunit 20D and increase the mean annual harvest of grizzly bears to 8-10% of the estimated population until survivals of moose calves increase.

METHODS

Successful hunters were required to have grizzly bears sealed at ADF&G offices. Data collected from each grizzly bear included sex, skull length and width; transportation used by the hunter; date of harvest; number of days hunted; location of kill,. and name, address and residency of hunter. A premolar was extracted from each bear skull for use in age determination.

RESULTS AND DISCUSSION

Population Status and Trend

The number of grizzly bears in Subunit 20D may be stable or increasing north of the Tanana River and stable or decreasing south of the Tanana River.

Population Size:

An accurate estimate of the size of the grizzly bear population is not available for Subunit 20D. Population size was calculated by multiplying the estimated 5,400 mi^2 of grizzly bear habitat in Subunit 20D by bear densities of 1 bear per 25 mi^2 to 1 bear per 35 mi^2 (i.e., 154-216 grizzly bears). This estimate was further divided into estimates for southern and northern Subunit 20D. Southern Subunit 20D is south of the Tanana River; it has

approximately 2,000 mi^2 of grizzly bear habitat (i.e., 57-80 grizzly bears). Northern Subunit 20D (north of the Tanana River) has approximately 3,400 mi^2 of grizzly bear habitat. The crude population estimate for this area suggests from 97 to 136 grizzly bears.

Population Composition:

Grizzly bear population composition is unknown for Subunit 20D. Because cubs or females accompanied by cubs may not be harvested, the sex ratio of the harvest was not used to estimate population composition.

Distribution and Movements:

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

Mortality

Season and Bag Limit:

The open season for all hunters in Subunit 20D are from 1 April to 31 May and 1 September to 30 November. The bag limit is 1 bear every 4 regulatory years; a resident grizzly bear tag is required. The harvest of cubs and females accompanied by cubs is prohibited.

Human-induced Mortality:

The reported grizzly bear harvest in Subunit 20D totaled 5 bears during 1988 (Table 2), representing 2-3% of the estimated population. This harvest nearly equalled the mean annual harvest of 6 bears for the previous 5 years. The 1988 harvest consisted of 80% males (Table 2).

Harvest Locations. Most grizzly bears (60%) killed in Subunit 20D were taken south of the Tanana River (Table 2). Similarly, during the previous 5 years (1984-88), 71-90% of the grizzly bears killed in Subunit 20D were taken south of the Tanana River. The majority of grizzly bears are killed in this area, because it is much more accessible than northern Subunit 20D and receives greater hunting pressure from moose, caribou, and Dall sheep hunters. During 1988, 1 bear was killed north of the Tanana River, and one was killed on the Tanana River.

Although the total harvest represents only 2-3% of the estimated population, there is a significant difference between harvest rates in the southern and northern portions of Subunit 20D. Based on the population estimate for southern Subunit 20D, a harvest of 3 bears represents 4-5% of the grizzly bears in that area. The harvest of only 1 bear in northern Subunit 20D represents approximately 1% of the grizzly bear population there.

Hunter Residency. Most hunters who kill grizzly bears in Subunit 20D are Alaskan residents, and 4 of 5 hunters who killed grizzly bears during 1988 were residents (Table 3). Most resident hunters probably killed bears while hunting other species such as moose, caribou, or Dall sheep.

Harvest Chronology. In Subunit 20D, most grizzly bears have historically been taken during the fall hunting season. During 1988, all of the grizzly bears were killed during the fall season (Table 4).

Transportation Methods. During 1988, most grizzly bear hunters used boats (Table 5).

Game Board Actions and Emergency Orders

No Board actions or Department Emergency Orders affected grizzly bears in Subunit 20D during 1988; however, the Board considered and rejected a proposal at the November 1988 meeting to eliminate grizzly bear tag fees and the bag limit (i.e., 1 bear/4 yrs) for northern Subunit 20D. The purpose of this proposal was to help meet the goal of harvesting 5-10 bears per year from northern Subunit 20D.

CONCLUSIONS AND RECOMMENDATIONS

The harvest of 5 grizzly bears in Subunit 20D during 1988 was the lowest since 1982 and below the mean harvest from 1983 to 1987 of eight per year. However, this harvest is within the range of 5-11 bears per year killed during that time.

During the 1983 to 1988 period the mean harvest in Subunit 20D has increased, compared with the period from 1976 to 1982 (Table 2). Most of this increase has occurred in southern Subunit 20D, which has only about 40% of the grizzly bear habitat but has accounted for 80% of the harvest during the last 5 years. Based on crude estimates of population size and harvest rates, grizzly bears in southern Subunit 20D have experienced heavy harvests and the population is declining.

Although the harvest in southern Subunit 20D may be responsible for a decline in the bear population, it has significantly benefited the ungulate populations. The current population objectives for moose and caribou in southern Subunit 20D is to increase their size; reduced grizzly bear predation should help achieve it. Low numbers of grizzly bears and other predators in southern Subunit 20D are associated with medium-to-high moose and caribou calf survival. Therefore, consideration should be given to reducing grizzly bear harvests in southern Subunit 20D; however, that reduction must be balanced against moose and caribou population objectives.

The harvest in northern Subunit 20D has been low, and the grizzly bear population is stable or increasing. Large numbers of predators, including grizzly bears, in northern Subunit 20D are responsible for low moose calf survivals to 6 months of age. Current objectives for moose stipulate increasing the population size. Measures should therefore be taken to increase the harvest of grizzly bears in this area; the most effective methods would be to liberalize the bag limit from 1 bear every 4 years to 1 bear every year and eliminate the resident bear tag requirement. These regulatory changes were submitted to the Board of Game during 1988, but they failed to pass. Grizzly bear seasons and bag limits should be liberalized in northern Subunit 20D, until moose calf survival increases.

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Table 1. Seasons and bag limits for grizzly bears in Subunit 20D, 1977-88.

Year	Season	Bag limit
1977	10 Sep-10 Oct 10-25 May	One bear every four years
1978	1 Sep-10 Oct 10-25 May	One bear every four years
1979-88	1 Sep-30 Nov 1 Apr-31 May	One bear every four years

Table 2. Annual reported harvest of male and female grizzly bears, north and south of the Tanana River in Subunit 20D, 1976-88.

	South of Tanana				North of Tanana				Unk		
Year	M	F	Total	(%)	M	F	Total	(%)	M	F	Total
1976	2	0	2	100	0	0	0	0			2
1977	3	1	4	67	1	1	2	33			6
1978	5	0	5	83	1	0	1	17			6
1979	0	2	2	100	0	0	0	0			2
1980	2	1	3	100	0	0	0	0			3
1981	1	1	2	40	1	2	3	60			5
1982	1	1	2	40	2	1	3	60			5
1983	3	6	9	82	1	1	2	18			11
1984	3	2	5	71	1	1	2	29			7
1985	3	2	5	71	2	0	2	29			7
1986	2	2	4	80	0	1	1	20			5
1987	8	1	9	90	0	1	1	10			10
1988	2	1	3	60	1	0	1	20	1[a]	0	5

[a] One bear was killed on the Tanana River, but location north or south of the Tanana was unknown.

Table 3. Residency of successful grizzly bear hunters Subunit 20D, 1976-88.

Year	Resident hunters	Nonresident hunters	Unknown residency
1976	2	0	0
1977	6	0	0
1978	5	0	1
1979	2	0	0
1980	3	0	0
1981	2	3	0
1982	3	2	0
1983	10	1	0
1984	7	0	0
1985	7	0	0
1986	5	0	0
1987	9	1	0
1988	4	1	0

Table 4. Harvest of grizzly bears in Subunit 20D during the spring and fall hunting season, 1976-88.

Year	No. of bears killed		
	Spring	Fall	Other
1976	0	2	0
1977	1	5	0
1978	0	6	0
1979	0	2	0
1980	1	2	0
1981	0	5	0
1982	0	4	1
1983	1	10	0
1984	2	5	0
1985	1	6	0
1986	3	1	1
1987	2	7	1
1988	0	5	0

Table 5. Transportation methods of successful grizzly bear hunters in Subunit 20D, 1981-88.

Year	Number hunters (%)				
	Airplane	Offroad vehicle	Boat	Horse	Other
1981	4 (80)	0	0	0	1 (20)
1982	3 (60)	1 (20)	0	1 (20)	0
1983	3 (27)	4 (36)	3 (18)	1 (9)	0
1984	3 (43)	0	1 (14)	1 (14)	2 (28)
1985	1 (14)	1 (14)	1 (14)	1 (14)	3 (43)
1986	0	2 (40)	3 (20)	0	2 (40)
1987	1 (10)	1 (10)	0	2 (20)	6 (60)
1988	0	0	2 (40)	1 (20)	2 (40)

STUDY AREA

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

Virtually all of Subunit 20E is grizzly bear habitat. Bears may be found from the high tundra in the western portion of the area to lowland marsh and muskeg habitats in the central and southern areas.

Grizzly bears were relatively abundant in this area in the 1940's, based on reports from people who mined in the Fortymile country at that time; their decline through the 1950's was concurrent with an aggressive federal wolf control program conducted from 1948 through 1950. It is likely that many bears were killed incidentally by either strychnine-laced wolf baits or M-44 cyanide "getters" set out for wolves.

Bears increased throughout the 1960's and were noticeably abundant by the mid-1970's. Even so, relatively few bears were taken by sport hunters prior to 1981, when grizzly bear hunting regulations were liberalized. Prior to 1981 more bears were probably killed by placer gold miners to protect their camps than by hunters.

Research conducted in the mid-1980's demonstrated that grizzly bears and wolves control moose population growth in Subunit 20E (Boertje et al. 1987). With an estimated density of 16 bears/1,000 km^2 and a ratio of 1 bear:5 moose, grizzly bears killed 52% of 33 calves collared as neonates and 6-9% of the early winter moose population in the study area. Predation by adult male bears on adult moose was greatest during the spring (1 kill:26 bear days), lowest during summer (1 kill:132 bear days), and intermediate during fall (1 kill:43 bear days), according to Boertje et al. (1987). Adult female grizzly bears without cubs of the year also killed adult moose and caribou as well.

In this area, where predation by grizzly bears has been documented to be a major cause of present depressed moose populations, the ungulate predation problem has been addressed through liberal bear hunting regulations. It must be recognized, however, that the reproductive rate of Interior grizzly bear populations is low and care must be taken not to threaten the

viability of those populations. In Subunit 20E this is unlikely, given the large expanses of lowland forested habitat, where hunter access is difficult and hunting pressure is low.

MANAGEMENT OBJECTIVES

To effect temporary reductions in the grizzly bear population or extent of bear predation where it is limiting moose population growth (i.e., fall calf:cow ratios < 30:100).

To sustain unitwide harvests of at least 25 bears.

To reduce bear harvests and reverse bear population declines after moose populations increase to desired levels.

METHODS

All grizzly bears harvested in Subunit 20E are required to be sealed in Subunit 20E or in Tok in Unit 12 prior to being transported out of the area (5 AAC 92.165). Premolar teeth extracted during the sealing process were later aged by ADF&G personnel in Anchorage. During 1985 and 1986 Boertje et al. (1987) captured and radio-collared 24 grizzly bears in southern Subunit 20E to estimate bear density and predation rates on calf and adult moose and caribou.

RESULTS AND DISCUSSION

Population Status and Trend

Grizzly bear numbers in Subunit 20E increased throughout the 1960's and 1970's, because of the cessation of federal predator control efforts and the protection afforded by conservative bear hunting regulations. The bear population remained roughly stable during the 1980's, with the possible exception of bears inhabiting more accessible areas where recent harvests have been concentrated.

Population Size:

Minimum grizzly bear density in the 1,544-mi^2 study area was calculated to be 16 bears/1,000 km^2 (1 bear/24 mi^2) (Boertje et al. 1987). If bear density is assumed to be similar throughout the 11,000-mi^2 area, Subunit 20E supports approximately 450 bears.

Population Composition:

Because of biases, no estimate of grizzly bear population composition can be made based upon harvest statistics; however, Boertje et al. (1987) estimated composition within their study

area as follows: 10 females ≥4 years old without young, 3 females with 5 yearlings or 2- to 3-year-olds, 6 females with 14 cubs of the year, and 15 subadults on their own.

Distribution and Movements:

Grizzly bears inhabit all portions of Subunit 20E, based upon incidental observations and sealing documents. There appears to be a general seasonal movement by bears to lowland, riparian areas in the early spring. Bears occupy all areas during the summer, but tend to move to subalpine areas as berry crops ripen during the fall. No seasonal bear concentration areas are known to occur in Subunit 20E, in contrast to other areas where grizzly bears concentrate on salmon spawning streams.

Mortality

Season and Bag Limit:

The open season for resident and nonresident hunters in Subunit 20E is from 10 August to 30 June. The bag limit is 1 bear. A bear taken in this unit does not count against the bag limit (i.e., 1 bear/4 yrs) in other units; however, no person may take more than 1 bear per regulatory year. Cubs and females accompanied by cubs are protected by regulation.

Human-induced Mortality:

Eighteen grizzly bears were harvested in Subunit 20E during 1988, compared with 24 bears in 1987 and the 5-year mean of 19 bears (Table 1). One of the 18 bears was an adult male taken in defense of life or property (DLP) on 13 June 1988 during the bear season. The management objective of maintaining annual harvests of at least 25 bears was not met. Given the liberal regulations and apparent hunting pressure, attainment of the 25-bear quota per year may not be reasonable.

Of the 18 bears taken, nine were males. Normally, male bears compose over 60% of the harvest. Three (75%) of the 4 bears taken during the spring were males, while males composed only 43% (n = 6) of the 14 bears taken during the fall. Ages of bears harvested in 1988 were not available at the time this report was written, but no clear trends in age or sex of bears harvested were evident.

Hunter Residency and Success. Resident hunters took 17 bears (94%), and nonresidents took one (6%). No measure of hunter success is available, because unsuccessful bear hunters are not required to submit reports.

Harvest Chronology. The 1st grizzly bear of the year was taken on 30 April, and the last was taken on 25 September. One bear was taken in April, two in May, one in June, three in August, and 10 in September. It is obvious from the harvest dates and

locations that all 3 bears taken in August were taken incidentally by caribou hunters, and all but one of the September bears were taken by moose and caribou hunters. The single successful nonresident hunter intentionally hunted for grizzly bears, as did the 3 successful bear hunters in the spring. The other bear taken during the spring was killed by a gold miner. Keeping bear seasons open concurrently with fall seasons for moose and caribou is the key to maintaining the high incidental harvests of bears. The bag limit (i.e., 1 bear/yr) and the waiver of tag requirements for residents contribute greatly to the maintenance of high grizzly bear harvests in Subunit 20E.

Natural Mortality:

According to Boertje et al. (1987), predation by adult male bears on sows and cubs was the major cause of observed natural mortality in Subunit 20E. Observed natural mortality rates for cubs of the year in 1986 was 60% (6 of 10). We also observed 2 cases in which adult females with cubs of the year were killed and consumed by adult males. In 3 of 4 cases of a missing cub or cubs, collared adult males were observed in the immediate vicinity.

Habitat

Assessment:

Virtually all of Subunit 20E is inhabited by grizzly bears. Subunit 20E is lacking certain bear food items that are more abundant in other areas supporting higher bear densities; for example, ground squirrels are not present in the area and salmon occur only in low numbers. Even ungulate prey species exist at low numbers in this area, compared with their densities in the 1960's and early 1970's, which may also explain why bears in Subunit 20E kill more big game prey than they scavenge (Boertje et al. 1987).

Enhancement:

The Alaska Interagency Fire Management Plan for the Fortymile Area designates over 60% of Subunit 20E as a limited-action or let-burn area to ensure a more near-natural fire regime than has existed for the past 30 years; it is expected to increase habitat productivity for grizzly bears as well as other wildlife species. The greatest potential for increasing the availability of animal protein for bears in this area is to increase the abundance of moose and caribou. Enhancement of the salmon run is less likely, given the history of and present interest in placer gold mining in Subunit 20E.

Game Board Actions

During this reporting period, the Board of Game reauthorized the waiver of the $25 resident grizzly bear tag fee in Subunit 20E.

The Board recognized the effectiveness of this regulation in the overall management plan to restore moose abundance in this area. In addition to reducing the incidence of false reporting of harvest locations, bear hunters who killed grizzlies in Subunit 20E were required to seal them in Tok beginning July 1987.

CONCLUSIONS AND RECOMMENDATIONS

The goal of providing the greatest sustained opportunity to participate in hunting grizzly bears in Subunit 20E is currently being met; however, annual harvests have not yet reached the objective of 25 bears per year. For this reason, it is unlikely that bear density has been reduced sufficiently to increase ungulate survival, except in a few localized areas such as the upper Middle Fork drainage where increased levels of bear hunting have occurred because of good access and visibility.

Additional liberalizations will be needed to achieve the harvest quota and predation reduction objectives. These may be achieved by allowing the harvest of a grizzly bear (1) on the same day a hunter is airborne, (2) with bait, or (3) female accompanied by cubs. It is possible that harvests could be increased in the future simply through incidental harvesting of grizzly bears by caribou hunters, if the Fortymile Caribou Herd continues to grow.

Bear predation on ungulates may also be reduced by diversionary feeding of bears in the vicinity of concentrated moose and caribou calving areas during late May and early June. This technique was apparently successful in the Mosquito Flats moose calving area during 1985, and it will be tested in Subunit 20D during 1990. Yet another possibility would be to administer contraceptives (i.e., progesterone implants) to reduce bear numbers in specific ungulate calving areas.

Management of ungulates and ungulate predators, including grizzly bears, must be coordinated, if ungulate populations in Subunit 20E are to regain their former numbers and productivity. At the present time, ungulates exist at low densities and predators are sufficiently abundant to maintain these densities. I recommend that annual harvests of ungulates remain conservative and annual harvests of grizzly bears be increased, to achieve management objectives for these respective species. In the long term, harvests of both predators and prey should be based upon sound biological data, to perpetuate moderate density populations of all big game species in the area and to provide for reasonable use opportunities for humans.

LITERATURE CITED

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Table 1. Harvest characteristics of grizzly bears taken in Subunit 20E, 1984-88.

Year	No. harvested (%)			No. males (%)		No. females (%)		No. spring	No. fall
	Total	Res.	Nonres.	Total	≥5 yrs.	Total	≥5 yrs.		
1984	20	16(80)	4(20)	10(50)	3(38)	10(50)	5(56)	3(15)	17(85)
1985	12	8(67)	4(33)	10(83)	7(88)	2(17)	2(100)	6(50)	6(50)
1986	22	21(95)	1(5)	12(55)	6(55)	10(45)	7(78)	9(41)	13(59)
1987	24	22(92)	2(8)	14(67)	8(57)	7(33)	4(57)	6(29)	18(71)
1988	18	17(94)	1(6)	9(50)	NA	9(50)	NA	4(22)	14(78)
Mean	19	17(86)	2(14)	11(61)	6(60)	8(39)	5(73)	6(31)	14(69)

STUDY AREA

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 occur in low-to-moderate numbers throughout the area; higher numbers occur in the more mountainous areas. Populations have been stable or slowly increasing with low annual harvests (i.e., less than 10 bears per year).

MANAGEMENT OBJECTIVES

To manage a grizzly population that will sustain a minimum annual harvest of 10 bears.

To reduce nuisance bears and the unreported harvest of those bears at fish camps during summer.

METHODS

The harvest was monitored through sealing requirements. The nuisance bear problem will be addressed through education, eradication, and changes in regulations.

RESULTS AND DISCUSSION

Population Status and Trend

I believe the population has been stable or slowly increasing, based on field observations, nuisance reports, and hunter sightings during the past 10 years.

Population Size:

No surveys have been conducted in the area; however, rough population estimates have been made, based on bear densities found for similar habitats for other Interior units. Using a figure of 1 bear/40 mi^2 in good habitat and 1 bear/100 mi^2 in the rest of the area, I estimate the population at 500-600 bears. The best bear habitat is found in the Nulato Hills and throughout Subunit 21C.

Mortality

Season and Bag Limit:

Except for Subunit 21A, the open seasons for all hunters are from 1 April to 25 May and from 1 September to 31 December. In Subunit 21A, the open season for all hunters are from 10 to 25

May and 1 September to 10 October. The bag limit is 1 bear every 4 years. The harvest of cubs and females accompanied by cubs is prohibited.

Human-induced Mortality:

Although the season has been liberalized (i.e., from 47 days in 1981, 129 in 1982-83, 139 in 1984-86, to the current 180 days) hunting pressure on bears has remained low. The area provides opportunities for quality grizzly bear hunting; 13 out of 75 bears made the Boone and Crocket minimum during the last 10 years. During 1988 only 5 bears were taken by sport hunters (Table 1). Although the number of bears killed at fish camps is not known, it is estimated to equal the reported harvest.

Hunter Residency and Success. There is no set pattern of harvest among user groups (Table 1), and almost all bears taken during fall are incidental to moose hunting. Harvest locations vary widely from year to year, and there are no set patterns or concentrations in single areas.

Game Board Actions and Emergency Orders

During the past 5 years the Board has increased the length of the seasons. The $25 tag fee was waived for 1985 and 1986, but it was reinstated for 1987 and 1988. The seasons were liberalized to increase the harvest during the spring (i.e., guided hunts), thereby decreasing the number of unreported DLP mortalities. The tag fee was waived to increase the incidental harvest and relieve the hardship of the tag fee on low-income license holders. Despite these regulatory efforts, the 10-year (1979-1988) average annual harvest is only 7 bears. Removal of the tag fee might increase the incidental harvest by 1 or 2 grizzly bears per year.

CONCLUSIONS AND RECOMMENDATIONS

The grizzly bear population is healthy and will be able to sustain a higher annual harvest. Until the tag fee is removed and hunting habits change, the human harvest will have a negligible effect on the grizzly bear populations in Unit 21.

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Table 1. Grizzly bear harvest statistics for Unit 21, 1983-88.

Year	Total	Males	Females	Unk	Res. hunters	Nonres. hunters	DLP	Spring	Fall
1983	7	4	1	2	3	4	1	5	1
1984	4	3	0	1	3	1	0	1	3
1985	11	9	2	0	4	7	0	7	4
1986	7	2	5	0	3	3	1	3	3
1987	7	2	5	0	3	4	1	2	4
1988	5	5	0	0	3	2	0	1	4

STUDY AREA

GAME MANAGEMENT UNIT: 22 (23,000 mi^2)

GEOGRAPHICAL DESCRIPTION: Seward Peninsula and that portion of the Nulato Hills draining west into Norton Sound.

BACKGROUND

Activities associated with gold mining and reindeer herding on the Seward Peninsula severely depleted grizzly bear numbers during the early 1900's. Intensity of these activities substantially declined during the mid-1940's, and bear numbers began to slowly recover, presumably reaching pre-1900 levels by the 1960's. The size of the population continued to increase in response to high densities of moose, reindeer, and numerous marine mammal carcasses on the beaches. Observations of staff conducting field activities and reports from local residents indicate that the Unit 22 bear population may now be at or near record-high levels.

Interest in harvesting grizzly bears among recreational (primarily from the Nome area) and trophy hunters is currently high. Mineral exploitation and reindeer herding activities in Unit 22 are again increasing.

POPULATION OBJECTIVES

To protect, maintain, rehabilitate, enhance, and develop grizzly bears and their habitat.

To provide for the optimum sustained use, both consumptive and nonconsumptive, of the grizzly bears consistent with the social, cultural, aesthetic, environmental, and economic needs of the public.

To maintain and/or increase viable grizzly bear populations consistent with environmental conditions, legal mandates, and public desires.

To minimize adverse interactions of grizzly bears with the public.

METHODS

Surveys or censuses to determine composition or size of the grizzly bear population in Unit 22 have never been conducted; however, observations were recorded during surveys of other game species and/or from general conversation with local residents. Harvest data were obtained from sealing certificates.

RESULTS AND DISCUSSIONS

Population Status and Trend

Seward Peninsula grizzly bear numbers are increasing; however, the rate and magnitude of increase is unknown. A study scheduled to begin in spring 1989 should provide some insight into the population status of bears in Unit 22.

Population Size:

The size of the grizzly bear population is unknown. Density estimates from studies conducted in Units 13 and 26 and Subunit 20A indicate the estimated number of bears in Unit 22 may ranges from 288 to 1,150 (Grauvogel 1986). However, it is questionable whether density estimates derived from studies conducted in other parts of Alaska are comparable, because of significant differences in topography, climate, food availability, and habitat.

Mortality

Season and Bag Limit:

The open seasons in Subunit 22C for subsistence, resident, and nonresident hunters are 1 September to 31 October and 10 to 15 May. The bag limit for subsistence and resident hunters is 1 bear every 4 regulatory years; the bag limit for nonresident hunters is 1 bear every 4 regulatory years by drawing permit only. The open seasons for the remainder of Unit 22 for subsistence, resident, and nonresident hunters are 1 September to 31 October and 15 April to 25 May. The bag limit is 1 bear every 4 regulatory years for all hunters, excluding nonresident hunters in Subunits 22B, 22D, and 22E who are entitled to 1 bear every 4 regulatory years by drawing permit only.

Human-induced Harvest:

The 1988 reported harvest was 28 grizzly bears (Table 1). This harvest, the lowest reported since 1983, was attributable to one or more of the following factors: (1) a reduction in length of the Subunit 22C spring season, (2) inclement spring conditions, or (3) the reintroduction of the $25 resident tag fee. Seven additional bears were killed in defense of life or property (DLP) during 1988. Addition of these bears to the reported harvest brings to 35 the known 1988 harvest for Unit 22.

Not all harvested bears are sealed, because some hides and skulls from bears taken in DLP are not surrendered to the Department. I estimate an additional 10 to 30 bears were killed and not reported.

Historical data generally indicate that more male bears were harvested than females. Sex composition of the harvests from 1961 through 1987 was 70% males and 30% females. Sex composition of the 1988 harvest was 17 males (59%) and 12 females (41%). Mean ages of harvested males, females, and both sexes combined were 7.4 (N = 16), 4.6 (N = 11), and 6.2 (N = 11) years, respectively. Thirteen bears (48%) were determined to be 5 years of age or younger, 11 bears (41%) were 6-10 years of age, and 3 bears (11%) were 11 years of age or older. As in past years, most of the 1988 harvest (76%) came from Subunits 22A and 22B (Table 2).

Hunter Residency and Success. Alaska residents took 55% (16 bears) of the reported harvest (Table 3). Five were taken during the spring season, and the remaining 11 were harvested during the fall. Nonresidents accounted for 45% (13 bears) of the reported harvest; 10 bears were taken in the spring and three in the fall.

Under the present system, it is difficult to obtain reliable data on resident hunter success, because unsuccessful resident hunters are not required to report or contact ADF&G representatives. General conversations with unit residents who have hunted grizzly bears in the past indicate that hunter success is usually high in the spring, particularly if suitable snow conditions exist. Limited data are available from nonresidents who drew permits to hunt bears in Subunits 22B, 22C, 22D, and 22E. During the spring hunt, 4 of 10 nonresidents who drew permits actually hunted, and all were successful in harvesting bears. During the fall 1988 hunt, 6 of the 10 nonresident permittees hunted, and two were successful in harvesting bears.

Permit Hunts. Nonresidents were required by the Board of Game in 1980 to obtain a drawing permit to hunt in Unit 22. During the following year, at the Department's request, the Board of Game eliminated the requirement in Subunit 22A. Since that time, 20 permits have been available annually to nonresidents wishing to hunt bears in Subunits 22B, 22C, 22D, and 22E. This regulatory change caused a considerable decline in bear harvest by nonresidents (Table 3). However, during the past 5 years, nonresidents have demonstrated renewed interest in hunting bears in Unit 22. All 20 permits were allocated during the spring and fall seasons of 1988.

Harvest Chronology. With the exception of 1976 and 1983, the spring bear harvests have always exceeded the fall harvests (Tables 1 and 3). Hunters generally favor the spring season, because snow machines can be used to efficiently access hunting areas. During the fall, access is much more limited.

Game Board Actions and Emergency Orders

A single proposal requesting the elimination of the $25 resident bear tag fee in Unit 22 was submitted and ultimately rejected by the Board of Game during the reporting period.

CONCLUSIONS AND RECOMMENDATIONS

Interest in the management of Seward Peninsula grizzly bears continues to steadily increase. Reindeer herders and campers consistently complain of "too many bears". Registered guides continually press the Board and the Department to liberalize or eliminate completely the nonresident permit requirement. Other local residents strongly feel that the increasing grizzly bear population is a major cause of moose calf mortality. A research program addressing productivity, population density, and interactions with ungulate populations is scheduled to start during the spring of 1989. Results of this study will assist the Department in objectively addressing these concerns.

Harvest reporting within the Unit falls into two categories: (1) sealing of bears taken during established hunting seasons and (2) reporting of DLP mortalities. Compliance in both categories is high in the communities of Nome and Unalakleet; however, compliance with harvest reporting and sealing requirements in other rural villages in the unit remains very low. Grizzly bears continue to be killed by rural residents and reindeer herders; these DLP mortalities are usually not reported. 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 regulations regarding DLP bears to improve overall compliance.

It is common knowledge that conventional wildlife management principles are not widely accepted by many residents of Unit 22. Also, many hunters do not purchase hunting licenses or hunt entirely within the established season dates and/or bag limits. Until these larger problems are resolved, improved compliance with existing grizzly bear regulations will most likely not be forthcoming.

Until more is known about the status of the Seward Peninsula grizzly bear population and current regulations are accepted with a greater degree of satisfaction, all regulatory changes that may conceivably increase the take of grizzly bears in Unit 22 should be rejected.

If not monitored closely, mineral exploitation and reindeer herding activities may again result in a reduction of bear numbers similar to what is thought to have occurred during the

early 1900's. Measures need be taken to assure overharvest of this species does not occur.

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Table 1. Historical chronology of Unit 22 grizzly bear harvest[a] from 1975-1988.

Year	Spring		Fall		Totals
	#	%	#	%	#
1975	5	(83%)	1	(17%)	6
1976	5	45%	6	55%	11
1977	9	64%	5	36%	14
1978	8	57%	6	43%	14
1979	40	80%	10	20%	50
1980	23	79%	6	21%	29
1981	16	57%	12	43%	28
1982	10	67%	5	33%	15
1983	7	25%	21	75%	28
1984	28	53%	25	47%	53
1985	28	53%	25	47%	53
1986	35	69%	16	31%	51
1987	22	52%	20	48%	42
1988	15	52%	14	48%	29

[a] Only includes those bears taken during established hunting seasons.

Table 2. Annual harvest of grizzly bears[a] in Subunit 22A-22E, 1979-88.

Year	22A	(%)	22B	(%)	22C	(%)	22D	(%)	22E	(%)	Totals
1979	10	20	28	56	8	16	3	6	1	2	50
1980	9	31	11	38	7	24	1	3	1	3	29
1981	9	32	4	14	13	46	1	4	1	4	28
1982	3	20	3	20	7	47	2	13	0	0	15
1983	11	39	12	43	0	0	4	14	1	4	28
1984	18	34	15	28	15	28	4	8	1	2	53
1985	18	34	19	36	9	17	7	13	0	0	53
1986	15	29	20	39	8	16	7	14	1	2	51
1987	18	43	18	43	3	7	3	7	0	0	42
1988	11	38	11	38	4	14	3	10	0	0	29
Mean											
1979-86	12	32	14	37	7	20	4	9	1	2	38

[a] Figures do not include DLP or illegally taken bears.

Table 3. Resident and nonresident grizzly bear harvests in Unit 22, 1976-88.

Year	Resident harvest			Nonresident harvest			Total harvest			Percentage of harvest by nonresidents
	S	F	Totals	S	F	Totals	S	F	Totals	
1976	4	5	9	1	1	2	5	6	11	18
1977	5	2	7	4	3	7	9	5	14	50
1978	4	2	6	4	4	8	8	6	14	57
1979	7	5	12	33	5	38	40	10	50	76
1980	10	2	12	13	4	17	23	6	29	59
1981	15	6	21	1	6	7	16	12	28	25
1982	10	2	12	0	3	3	10	5	15	20
1983	6	14	20	1	7	8	7	21	28	29
1984	18	14	32	10	11	21	28	25	53	40
1985	20	13	33	8	12	20	28	25	53	38
1986	21	8	29	14	8	22	35	16	51	43
1987	9	12	21	13	8	21	22	20	42	50
1988	5	11	16	10	3	13	15	14	29	45

[a] Only includes those bears taken during established hunting seasons.

STUDY AREA

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

GEOGRAPHICAL DESCRIPTION: Kotzebue Sound and western Brooks Range

BACKGROUND

Prior to 1961 no harvest information was collected. Data on number, sex, age, and location of brown bears harvested in Alaska have since been recorded annually through a sealing program; however, biologists have suspected that this information is incomplete, particularly in rural Alaska. A recent survey conducted by Loon and Georgette (1989) indicated that local hunters in Unit 23 may have actually taken twice as many bears as were reported through the sealing program. The magnitude of the harvest attributable to nonlocal resident and nonresident hunters appears to be better documented.

Research on the population status of brown bears in Unit 23 began only recently. In 1983 an investigation was initiated in the Squirrel River drainage to evaluate LANDSAT imagery as a tool for describing brown bear habitat (Craighead et al. 1985). In 1986 intensive research was begun in the Noatak River drainage to collect baseline information on the density, sex and age composition, movements, and productivity of bears in the vicinity of the Red Dog Mine (Ballard et al. 1988). This information will be used to evaluate the long-term effects of the Red Dog project and to assess the impacts of human harvest on bear populations in that area.

POPULATION OBJECTIVES

To develop a management plan.

To improve the accuracy of our harvest information and collect baseline information on the density, status, and demography of bear populations.

METHODS

Methods used to census bears and collect movement and demographic information were described by Ballard et al. (1988). Methods used to assess harvest rates in the vicinity of the Red Dog Mine project were described by Ballard et al. (1989a). Harvest information was summarized from sealing certificates. Public comments concerning bear numbers and harvests were documented by Department personnel opportunistically during village visits to review game regulations.

Hunter success in 1988 was compared with previous years by ranking the total number of bears harvested (1 = highest to 18 = lowest), the number of hunter-days expended per bear harvested (1 = lowest to 17 = highest), and then summing these two values. A low combined value indicates a "successful" year (i.e., a high total harvest and low number of days expended per bear harvested). One shortcoming of this technique is that only successful hunters are considered. Unsuccessful hunters are not required to submit a harvest report.

RESULTS AND DISCUSSION

Population Status and Trend

The census conducted in the Noatak and Wulik River drainages during June 1987 indicated that the density of bears was 1 bear/19.4 mi^2 for all age classes and 1 bear/25.7 mi^2 for adult bears (Ballard et al. 1988). This estimate is higher than 1 bear/40 mi^2 estimate reported by Quimby (1984) for Unit 23, but it is in close agreement with the 1 bear/20 mi^2 estimate reported by Reynolds (1982) for high-quality habitat on the western North Slope in Subunit 26A. Reports from local residents and guides suggested that brown bears are currently abundant throughout Unit 23 and the size of the population has recently been increasing.

Mortality

Season and Bag Limits:

The open seasons in Unit 23 for subsistence, resident, and nonresident hunters are 1 September to 10 October and 15 April to 25 May. The bag limit for subsistence and resident hunters is 1 bear every 4 regulatory years. The bag limit for nonresident hunters is 1 bear every 4 regulatory years by drawing permit only; 25 permits will be issued (i.e., 7 spring and 18 fall).

Human-induced Mortality:

Nineteen brown bears (15 males and 4 females; 79% and 21% respectively) were harvested during 1988, including 1 DLP bear killed at Sheshalik (Table 1). The current harvest is considerably lower than those reported for most years since 1970. Poor snow conditions, which increased the difficulty of traveling and hunting during the spring season, probably contributed to the lower-than-normal harvest. Ballard et al. (1989a) assessed annual bear harvest rates from 1983 to 1987 as ranging from 8% to 16%. Because they also indicated that harvests approached or exceeded sustained-yield levels reported as acceptable in the literature, they recommended against liberalizing seasons.

Poor hunting conditions in the spring of 1988 not only reduced the number of bears harvested but apparently reduced hunter

efficiency as well (Table 2). The number of hunter-days expended per bear harvested is the highest reported since 1969. As in 1987 most of the harvest was reported from the Noatak River drainage (Table 3). The mean age of bears that were sealed in 1988 was 8.3 years, not substantially different from those of previous years (Table 4). The mean skull size for board was 21.7 inches (N = 13), slightly lower than the 1987 mean of 22.5 inches (N = 21). For sows, mean skull size was 19.9 inches (N = 3). A minimum of 2 marked bears were reported taken during 1988.

Hunter Residency and Success. Nonresident hunters harvested 7 of the 18 bears (39%) that were reported for 1988. There were more than twice as many applicants as permits available for each of the spring and fall nonresident permit hunts. At least 1 active guide has expressed concern that antihunters who had no intention of filling their permits received some of the 25 nonresident brown bear permits to prevent some harvesting of bears.

Harvest Chronology. Of the 18 bears taken during the regular hunting seasons, three (17%) were harvested during the spring and 15 (87%) were taken during the fall. Since 1969 the mean age of bears harvested has been greater in the spring than in the fall in 18 out of 20 years. Likewise, the mean skull size of bears has been greater in spring than in fall.

These data suggest that older, large bears were more vulnerable in the spring than in the fall. Older males may emerge from dens before other sex and age groups of bears, and favorable spring snow conditions increase the mobility of hunters, make bears more visible, and provide tracks that help hunters find and judge the size of bears.

Transport Methods. Four of the 18 grizzly bears taken during the regular hunting seasons were harvested using boats, 12 were taken using aircraft, one was taken using a snow machine, and one was taken using a dog team.

Natural Mortality:

Natural mortality rates among adult brown bears have not yet been estimated for Unit 23. Ballard et al. (1989a, 1989b) observed a large number of lactating sows without cubs during capture operations, suggesting that some sows were losing young cubs shortly after den emergence. Large boars kill cubs when the opportunities arise.

Habitat Assessment

Habitat assessments conducted in Unit 23 by the Wildlife-Wildlands Institute of Missoula, Montana has examined the applicability of LANDSAT photo imagery as a habitat assessment tool, rather than as a means for estimating any population parameter such as carrying capacity or population size (Craighead et al. 1985). Reynolds (1982) reported that bear density in

high-quality habitat on the North Slope in Subunit 26A was approximately 1 bear/20 mi^2. The Noatak/Wulik River area in the vicinity of the Red Dog Mine is good-quality denning habitat, and reported bear densities approached that of good-quality habitat on the North Slope.

The Red Dog development complex remains the most significant habitat alteration for bears in Unit 23. To date, managers of the mine and port sites have minimized contact between bears and people by prohibiting use of airstrips by nonessential aircraft, restricting personnel to the immediate port and mine sites, and limiting traffic on the road that connects the 2 sites. Refuse dumps, however, continue to attract bears. Refuse should be incinerated completely and, in the future, dumps may need to be fenced. Interestingly, a den site in view of the mine has not been used since construction began 2 years ago.

CONCLUSIONS AND RECOMMENDATIONS

Several guides and many residents of Unit 23 have requested that brown bear hunting regulations be liberalized. Guides want the number of bear permits available to nonresidents increased. Some resident hunters have requested that the spring bear season be opened as early as 1 April and the fall season by 1 August, the $25.00 tag fee be eliminated for subsistence hunters, and subsistence hunters be allowed to harvest a bear more frequently than once every 4 regulatory years.

If the brown bear density reported by Ballard et al. (1988) and the sex and age data from harvest information are accurate, requests for liberalizing the Unit 23 brown bear season and/or bag limit cannot be accommodated without causing the bear population to eventually decline (Ballard et al. 1989[a]). No trend toward younger or smaller bears of either sex in the reported harvest has been observed since 1969 (Figs. 1 and 2). Such a trend would normally be indicative of overharvesting. As already indicated, however, our harvest data is currently incomplete. Research conducted by Loon and Georgette (1989) indicates that relatively few local hunters report their harvest, and the size and age-sex structure of the actual harvest attributable to local hunters is unknown.

In addition, many hunters, particularly recreational and trophy hunters for whom our harvest data is most complete, selectively harvest larger bears. As long as the number of large bers in the population is sufficient to satisfy the demand, the age composition of the harvest could remain unchanged for some time, even if the actual proportion of large bears in the population is decreasing. The sex and age data reported by Ballard et al. (1988) indicated that the population near the Red Dog Mine may be skewed toward young males; this was not evident for females. Reducing the proportion of old boars in the population may or may not affect the productivity of the brown bear population. If old

boars are essentially eliminated from the population, hunters may begin taking large sows. This could reduce bear productivity in the unit.

Future budget projections indicate that an intensive study to estimate the size, sex-age composition, and status of bear populations in other portions of the unit is probably not feasible. I recommend that the Department develop a management plan for brown bears in Unit 23, conduct additional research on the use of aerial surveys in the Red Dog Mine study area during the spring of 1990 to determine whether counts of tracks or bears can be used to estimate brown bear abundance, and continue information and education efforts among Unit 23 residents by explaining the need and applicability of sealing and harvest information for brown bear management.

To minimize the potential for antihunters to monopolize bear permits, 1 guide suggested that nonresident permit applicants be required to state the name of their guide on their hunting application and that guides be required to supply a list of their clients who have applied for a permit to the Department prior to the drawing. The Department could then cross reference the 2 lists and exclude applicants who have not contacted legal guides. Because nonresidents may also hunt with relatives within the 2nd degree of kindred, such a system would need additional modifications before implementation. Given the poor quality of our harvest data, the limited geographic scope of good population information, and the low productivity of brown bears, no changes in seasons or bag limits are recommended at this time.

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Table 1. Reported grizzly bear harvest from Unit 23, 1970-1988.

Year	Males	Females	Unknown sex	Total
1970	20	8	1	29
1971	7	6	0	13
1972	20	6	2	28
1973	20	10	1	31
1974	11	3	0	14
1975	9	4	0	13
1976	13	4	1	18
1977	34	7	0	41
1978	26	12	1	39
1979	43	14	0	57
1980	14	11	1	26
1981	19	3	0	22
1982	19	11	2	32
1983	30	10	0	40
1984	32	15	1	48
1985	28	6	3	37
1986	20	14	0	34
1987	23	10	2	35
1988	15	4	0	19
Total	403 (70%)	158 (27%)	15 (3%)	576

Table 2. Reported numbers of brown bears harvested, hunter effort exerted each year, and rankings of bear numbers and hunter success each year relative to other years in Unit 23, 1969-1988.

Year	Hunter days	Total bears killed[b]	Hunter days/ bear[c]	Ranking points	Overall ranking
1969	30	14 (16)	2.1 (1)	17	6
1970	72	29 (11)	2.4 (4)	15	4
1971	64	13 (17)	4.9 (16)	33	12
1972	105	28 (12)	3.7 (11)	23	9
1973	89	31 (10)	2.9 (6)	16	5
1974	42	14 (16)	3.0 (7)	23	9
1975	31	13 (17)	2.4 (3)	20	8
1976	41	18 (15)	2.3 (2)	17	6
1977	124	41 (3)	3.0 (7)	10	2
1978	170	39 (5)	4.3 (13)	18	7
1979	197	57 (1)	3.4 (9)	10	2
1980	95	26 (13)	3.6 (10)	23	9
1981	95	22 (14)	4.3 (13)	27	10
1982	79	32 (9)	2.5 (4)	13	3
1983	111	40 (4)	2.8 (5)	9	1
1984	229	49 (2)	4.8 (15)	17	6
1985	165	37 (6)	4.4 (14)	20	8
1986	143	34 (8)	4.2 (12)	20	8
1987	111	35 (7)	3.2 (8)	15	4
1988	90	18[a] (15)	5.0 (17)	32	11
Total	2,083	589			

[a] Excludes bears harvested in defense of life and property.

[b] Numbers in parentheses represent rank numbers for numbers of bears killed during each year relative to all years; 1 = highest; 17 = lowest.

[c] Numbers in parentheses represent rank numbers for hunter erffort for each year relative to all years; 1 = highest; 17 = lowest.

Table 3. Locations of reported grizzly bear harvest in Unit 23, 1970-1988.

Year	Noatak	Kobuk	Wulik/ Kivalina	Selawik	Chuckchi Sea Coast	Northern Seward Pen.	Unknown	Total
1970	15	7	3	0	3	0	1	29
1971	7	2	3	0	0	1	0	13
1972	23	3	0	0	2	0	0	28
1973	15	3	5	1	5	2	0	31
1974	5	1	3	0	5	0	0	14
1975	6	0	3	1	2	1	0	13
1976	9	2	4	0	2	0	1	18
1977	22	5	1	2	7	4	0	41
1978	24	5	3	1	6	0	0	39
1979	12	3	11	5	2	18	6	57
1980	8	5	7	1	1	4	0	26
1981	10	5	3	1	1	1	1	22
1982	20	6	2	1	3	0	0	32
1983	20	4	6	1	6	3	0	40
1984	32	7	1	0	4	4	0	48
1985	25	6	1	2	2	1	0	37
1986	18	8	6	0	0	1	1	34
1987	19	6	5	0	4	1	0	35
1988	11	5	1	0	1	1	0	19
Total	301 (52%)	83 (14%)	68 (12%)	16 (3%)	56 (10%)	42 (7%)	10 (2%)	576

Table 4. Mean ages in years of male and female grizzly bears reported harvest from Unit 23, 1969-1988[a].

Year	Males		Females		Total	
	n	Mean age (S.D.)	n	Mean age (S.D.)	n	Mean age (S.D.)
1969	8	7.1	2	7.3	10	7.1
1970	11	6.3	4	6.7	15	6.4
1971	7	10.8	6	7.7	13	9.4
1971	19	10.7	6	11.5	25	10.9
1973	18	8.3	10	5.9	28	7.5
1974	11	7.6	3	3.4	14	6.7
1975	7	10.1	4	5.0	11	8.2
1976	12	8.9	4	6.6	16	8.3
1977	29	7.6	6	5.6	35	7.2
1978	26	8.3	12	8.2	38	8.3
1979	42	7.8	14	5.9	56	7.3
1980	12	7.2	10	7.5	22	7.3
1981	17	7.5	3	5.7	20	7.2
1982	15	7.7	10	12.3	25	9.6
1983	28	6.4	10	5.0	38	6.0
1984	30	8.5	14	8.6	44	8.5
1985	28	8.4	5	6.9	33	8.2
1986	19	10.0	13	6.1	32	8.4
1987	23	9.2	9	8.2	32	8.9
1988	11	9.1	4	6.1	15	8.3
Total	373	8.4 (1.3)	149	7.0 (2.1)	522	8.0 (1.2)

[a] Does not include bears with unreported sex or age.

STUDY AREA

GAME MANAGEMENT UNIT: 24 (26,092 mi^2)

GEOGRAPHICAL DESCRIPTION: Koyukuk River drainage upstream from the Dulbi River

BACKGROUND

Grizzly bears occur in moderate numbers throughout Unit 24, with higher numbers occurring in the mountainous areas. The north slope of the Brooks Range is the northern limit of the grizzly bears range in Alaska. Upland areas compose about one-third of the unit. Information is scant about bear populations within the unit, and most of the past references about densities have been 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). Unfortunately, all of these studies were conducted in portions of the Brooks Range where the open terrain makes observations and hunting relatively easy, and the applicability of the studies results to Unit 24 is questionable.

Reynolds (1989) estimated the grizzly bear population in Unit 24 at 770-930, based on density estimates for Subunits 26B and 26C (i.e., Canning River). The harvests since 1961 have rarely exceeded 15 bears, except when the Alaska Peninsula initiated an alternalte-year closure in the early 1970's that resulted in increased hunting pressure over the rest of the state. The annual harvest of bears in Unit 24 reached a maximum of 31 bears during that period. To prevent any overharvesting, a drawing-permit system (i.e., 40 permits) was established in 1977. In 1978 the permit area was reduced to the northern part of the unit the southern boundary following a convoluted line ". . . beginning at the north shore of Norutak Lake, thence along the Continental Divide to Helpmejack Creek, thence down Helpmejack Creek to its confluence with the Alatna River, thence down the Alatna River to its confluence with the Koyukuk River, thence up the Koyukuk River and South Fork Koyukuk River." The number of permits remained at 40.

In 1982 (i.e., creation of Gates of the Arctic National Park) the number of drawing permits available outside the park was reduced to 20. For subsistence hunters within the park, the season remained open all year, bag limits increased to one per year, and a registration permit system was established (i.e., 10 permits). In 1983 the number of drawing permits outside the park was once again increased to 40. In 1984 the number of drawing permits was reduced to 30 and the number of registration permits within the park increased to 20. In 1985 the drawing-permit system was changed to a registration permit system and the harvest quota to 20 bears; however, in 1987 it was reduced to 15 bears and the permit area was redescribed as "Koyukuk River upstream from and

including the Alatna River." The permit system was dropped for the Gates of the Arctic National Park.

Bear populations have been stable and slowly increasing; annual harvests have been low (i.e., usually less than 15 bears). Local hunting pressure has been low, although the opening of the Dalton Highway 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 them.

MANAGEMENT OBJECTIVES

To sustain maximum annual harvests of 18 grizzly bears in the northern portion of the unit and 13 bears in the remainder.

To reduce nuisance complaints, increase sealing compliance, and reduce the unreported harvest in the unit.

To work with U.S. National Park Service and U.S. Fish and Wildlife Service to determine density throughout the unit.

METHODS

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

RESULTS AND DISCUSSION

Population Status and Trend

I believe the population has been stable or slowly increasing, based on field observations, nuisance reports, and hunter sightings during the past 10 years. Also, the low harvests (i.e., less than 4% per year) have been contributing to an increasing population.

Population Size:

No surveys have been conducted in the area; however, population estimates have been based on bear densities found in similar habitats on the northern slopes of the Brooks Range. In the mountains and foothills of the Canning River area, densities ranged from 1.00 to 1.75 grizzly bears/100 mi^2 (Reynolds 1976). In contrast, in a study area in the western Brooks Range, densities were about 4 bears/100 mi^2; these higher densities were thought to be due to the large number of caribou in the area (Reynolds and Hechtel 1984). Reynolds (1987), however, used a figure of 1 bear/100 mi^2 in estimating the overall North Slope population in both mountainous and coastal plain habitat. In the Alaska Range, Reynolds and Hechtel (1988) found densities around

3.8 bears/100 mi^2. Because Unit 24 has a fairly substantial ungulate prey base and number of salmon streams, I suspect that the grizzly bear density is higher than the estimate Reynolds (1987) has used. Using a figure of 2.6 to 3.4 bears/100 mi^2 for the northern 13,225 mi^2 and 1.25 to 2.50 bears/100 mi^2 in the rest of the unit, the northern population is 350 to 450 bears and that for the rest of the unit is 160 to 322 bears: a unit-wide population of 510 to 772 bears.

Mortality

Season and Bag Limit:

In the drainages of the Koyukuk River upstream from and including the Alatna River, subsistence hunters living in Anaktuvuk Pass can take 1 bear per year from 1 September through 31 October and from 1 April through 31 May. In this same portion of the unit, registration permits were required of all other hunters. The bag limit was 1 bear every 4 years, with an open season of 1 September to 31 October and 10-31 May. In the remainder of the unit the open season is from 1 September to 31 December and 10-25 May; the bag limit is 1 bear every 4 years.

Human-induced Mortality:

Hunting pressure on bears in the southern part of the unit was low, although the season has been liberalized (i.e., from 55 days [1981-1983] to 137 days [1984-1988]). During 1988, 15 bears were harvested by sport hunters (Table 1). The number of DLP mortalities at fish camps by trappers is not known, but it is estimated at about 3 bears. Some of the bears, whose harvests were reported as the nonpermit areas of Unit 24, were probably taken in Unit 23 (i.e., two in 1986, 10 in 1987, and four in 1988).

Hunter Residency and Success. The registration permit system has not been adequately managed by ADF&G since its inception in 1985. During the spring hunt, 100 permits were printed, eight were issued and accounted for, 46 were issued and unaccounted for, and five were returned by hunters (only one successful but two sealed). During the fall of 1988, all 38 permits issued were accounted for, and reminder letters were sent to hunters who did not return their reports. Most of the permits went to moose hunters who were not planning to specifically hunt grizzly bears. Only one of the 8 bears killed was taken was by a guided nonresident.

Game Board Actions and Emergency Orders

During the past 5 years, Game Board regulatory actions have mainly dealt with the effects of the creation of Gates of the Arctic National Park on bear hunting opportunities and subsistence. In 1983 there were 40 drawing permits available to

sport hunters outside the park and 10 registration permits available to subsistence hunters inside the park. In 1984 the number of drawing permits was reduced to 30 and the number of registration permits for subsistence users in the park increased to 20. In 1985 the drawing-permit system was changed to a registration permit system, with a harvest quota of 20 bears. In 1987 the quota was reduced to 15 bears and the registration permit system within the park was eliminated.

CONCLUSIONS AND RECOMMENDATIONS

The management objective for grizzly bears within the unit is to sustain a harvest that does not exceed 18 and 13 bears in the northern and southern portions of Unit 24, respectively. Based on the estimated sustainable harvest rate elsewhere in Interior Alaska of 4%, a harvest of 20 to 31 bears could be sustained. I am not convinced that conclusions about overhunting based on observations from the open terrain of the northern slopes of the Brooks Range are valid within most of the northern part of Unit 24. I recommend the registration permit system be dropped and consideration be given to elimination of the tag fee for resident subsistence hunters.

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Table 1. Grizzly bear harvest statistics for Unit 24, 1983-88.

Year	Total	Males	Females	Unk	Res. hunters	Nonres. hunters	DLP	Spring	Fall
Permit area									
1983	6	6	0	0	4	2	0	2	4
1984	5	5	0	0	3	2	0	2	3
1985	3	2	1	0	1	1	2	2	1
1986	8	4	4	0	7	1	0	3	5
1987	11	9	2	0	7	4	1	2	9
1988	8	5	2	1	7	1	0	2	6
Rest of unit									
1983	6	4	2	0	4	2	0	0	6
1984	2	1	1	0	1	1	0	0	2
1985	2	1	1	0	1	1	0	0	2
1986	3	2	1	0	2	1	0	1	2
1987	10	7	3	0	0	10	0	5	5
1988	7	4	2	1	3	4	0	0	7

STUDY AREA

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

GEOGRAPHICAL DESCRIPTION: Eastern north slope of the Brooks Range and upper Yukon River drainage

BACKGROUND

Harvest statistics suggest that the development of aircraft-supported, guided grizzly bear hunting in the mid-1960's may have resulted in population declines in areas that were best suited for this activity. Adjusting season lengths and opening dates in the western subunits of the Brooks Range did not solve the problem. Illegal harvest and false-location reporting of grizzly bear harvest were common during this period, and eventually Subunits 26B and 26C were closed to hunting in 1971-72. Since then, a variety of regulations, primarily drawing-permit hunts, have resulted in low harvests and increased abundance of grizzly bears.

In the early 1970's a continuous series of studies in the Brooks Range began. Research in the eastern Brooks Range from 1971 through 1975 demonstrated that population density, productivity, and recruitment were lower than for grizzly bears at lower latitudes (Reynolds 1976). As a result of these continuing studies (Reynolds and Hechtel 1984, Garner et al. 1984, Reynolds and Garner 1987), it was recommended that harvest levels be held to less than 3% of the estimated populations until the populations had increased in Units 25 and 26. Beginning in 1977, the harvest was limited by permit hunting as required, and populations generally increased. In most areas, permits are now required only for nonresidents. Hunting management is now directed toward maintaining or increasing the grizzly bear populations and allowing a harvest of 4-6% of the estimated population.

MANAGEMENT OBJECTIVES

To maintain a mean annual harvest of less than 35 grizzly bears while maintaining a minimum of 60% males in the harvest in Unit 25.

To determine population size and composition by 1992 for Subunit 25A and Unit 26.

To maintain a mean annual harvest of less than 25 grizzly bears and a minimum of 60% males in the harvest in Unit 26.

METHODS

The size and density of the grizzly bear population were estimated during research studies conducted in Subunits 26B (1973-75) and 26C (1982-87) (Reynolds 1976, Garner et al. 1984, Reynolds and Hechtel 1984) and extrapolated to other areas of the Brooks Range units. Harvest data are gathered from mandatory sealing documents.

RESULTS AND DISCUSSION

Population Status and Trend

With the reduction in hunting pressure as a result of the permit system in 1977, bear populations began to recover or increase in Subunits 25A and 26C (Garner et al. 1984, Reynolds and Hechtel 1984). These conclusions are supported by observations from other biologists and guides. Bear populations in eastern Subunit 26B are stable. Hunting pressure continues to be low in Subunits 25B and 25D, and populations are stable.

Population Size:

Estimates of population sizes in the Brooks Range units were based on density estimates determined in 2 small (1,500-2,500 mi^2) areas (Reynolds 1976, Reynolds and Hechtel 1984). In addition, a density estimate was made for the northern Arctic National Wildlife Refuge, based on the preliminary findings of Reynolds and Garner (1987). Rough extrapolation from these estimated densities resulted in a population estimate of 1,320-1,570 bears for the entire study area (Table 1).

Population Composition:

Preliminary analysis of data from research conducted in Subunit 26C indicates an even-sex ratio for grizzly bears older than yearlings (Garner et al. 1984). In the northern portion of the Arctic National Wildlife Refuge, preliminary data indicated the following percentages by age classes: cubs, 19.6%; yearlings, 1.8%; 2-year-olds, 10.8%; 3- and 4-year-olds, 17.8%; and $\geq$5 years of age, 50.0% (Reynolds and Garner 1987).

Distribution and Movements:

Grizzly bears are distributed throughout the area; densities are generally highest in foothill portions of the area, moderate in alpine areas, and lowest on the coastal plain of the North Slope. No general movement patterns have been documented, except on the Arctic National Wildlife Refuge, where some grizzlies move from the mountains and foothills to the coastal plain when calving caribou are available.

Mortality

Season and Bag Limit:

Seasons varied among the subunits in the area, but the bag limit was consistent for all hunters at 1 bear every 4 regulatory years. The only subsistence seasons were in Unit 26. Open seasons in Subunits 25A (within the Hodzana River drainage), 25B, and 25D were 1 September-10 October and 10-25 May. Seasons in the remainder of Subunit 25A and Subunits 26B and 26C were 1 September-31 October and 10-31 May, including the subsistence seasons in Subunits 26B and C. A drawing permit was required for nonresident hunters in the following areas: Subunit 25A, the Sheenjek, Coleen, and Porcupine River drainages (9 permits issued); the East Fork Chandalar and Christian River drainages (9 permits issued); and the Chandalar River drainage excluding the East Fork Chandalar River (9 permits issued); Subunit 26B (10 permits issued); and Subunit 26C (5 permits issued).

Human-induced Mortality:

Harvest in the study area was 43 in 1988, compared with 45 in 1987, which represented a sharp increase from the 1986 harvest of 27 bears (Table 2). There were only 6 bears taken in the nonpermit areas of Unit 25. The number taken in Subunit 26B declined by 40% to nine, which was similar to harvests prior to 1987. Harvest in Subunit 26C was typical at 8 bears, one of which was taken in defense of life or property. The harvest in Subunit 25A, however, increased in 1988 by 62% to 21 bears, exceedung the allowable harvest of 4%; i.e., based on the estimated population size of 430 (Table 1). This jump in the harvest appears to reflect greater hunting pressure in Subunit 25A, rather than a higher population. If the bear harvest in Subunit 25A continues to climb, some remedial action will be necessary to limit harvest.

In general, the average harvest rate for grizzly bears in the study has been within sustainable levels. Males composed 74% of the harvest overall, as well as within the Brooks Range, well above the management objective minimum of 60% males. However, increased interest in hunting and the access afforded to hunters by the Dalton Highway and airstrips in many of the drainages will require closer monitoring of bear populations and hunting activity in the eastern Brooks Range.

The level of illegal harvest is unknown, but it is probably more common close to villages and probably less common within the eastern Brooks Range. Much of the unreported harvest is probably in relation to defense of life or property. Harvest reporting by local residents must be improved for grizzly bears, and this will be best achieved through further education on hunting seasons, bag limits, and sealing requirements.

Hunter Residency and Success. Of successful hunters, residents accounted for 40% of the harvest for Units 25 and 26. By unit, residents accounted for 10 of 26 bears legally taken in Unit 25 and seven of 16 taken in Unit 26; DLP mortalities were not included in these totals.

Permit Hunts. During the reporting period, drawing permits were required for nonresident hunters in Subunits 25A, 26B, and 26C. The harvests by permitted hunters were as follows: Subunit 25A (east) 3; 25A (central), 4; 25A (west), 4; 26B, 6; and 26C,3 grizzly bears. Total harvest for those in areas requiring permits was 37 (Table 2); harvest by nonresident permit holders was 20. Eleven successful hunters used airplanes, five used horses, three used snowmachines, and one used a boat.

Natural Mortality:

In the western Brooks Range area, natural mortality rates were 47% for cubs, 12% for yearlings, and 13% for 2-year-olds (Reynolds and Hechtel 1984).

Game Board Actions and Emergency Orders

Beginning with the 1977-78 regulatory year, permits were required to hunt grizzly bears in these areas, and reported harvest declined to less than 50. Initial permit allocation was as follows: Unit 25 and Subunit 26C, 48 (10 of these for the Arctic National Wildlife Refuge); Subunit 26B, 16. Major changes to the permit system by regulatory year included (1) boundary adjustments, excluding portions of the units where bears were less vulnerable to hunting, in 1978-79; (2) drawing permits for hunters in Subunit 26B and for nonresident hunters only in Subunits 25A and 26C in 1982-83; (3) registration permits in Subunit 26B (1-10 October and 1-10 May) in 1985-86; and (4) drawing permits for nonresident hunters only in Subunit 26B in 1987-88.

CONCLUSIONS AND RECOMMENDATIONS

Management objectives are being met in the study area, and most of the harvest has occurred at sustainable levels. The 1988 harvest in Subunit 25A, however, will require closer monitoring of the harvest and population. If the harvest trend continues upward, some type of change in the permit system will be needed to prevent overharvesting. The harvest in Subunit 26B appears to have returned to a more normal level from the high in 1987, but that area and Subunit 26C will also need closer monitoring to ensure that future harvest levels are not excessive. No changes in the present permit system are recommended at this time; however, I recommend that the Department cooperate with the U.S. Fish and Wildlife Service to conduct population surveys in Subunits 25A, 26B, and 26C beginning in FY 1990.

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Table 1. Sustainable and reported 1988 grizzly bear harvests in the Brooks Range based on estimated population densities and an allowable harvest rate of 4%.

Area	Area (mi^2)	Estimated density/ 100 mi^2	Estimated population size	1988 mortality[a]		
				Harvest @ 4%	Permit areas	Non-permit areas
Unit 25						
A	19,500	2.2	430	17	20	1
B and D	22,000	1.7-2.2	380-480	15-19		5
Subunit 26B						
Northern[b]	7,500	1.0	80	3		
Southern[b]	6,100	2.2	130	5		
Subtotal	13,600		210	8	9	
Subunit 26C	9,100	3.3-5.0	300-450	12-18	8	
Total	77,800		1,320-1,570	52-62	37	6

[a] Includes all human-caused mortality. In permit areas, permits are required for nonresidents. In open areas of Unit 25, no permits are required.

[b] Northern and southern portions of Subunit 26B correspond to areas of different estimated grizzly bear densities.

Table 2. Human-induced mortality of grizzly bears in Units 25 and 26, 1977-88.

Unit	Estimated population	Human-caused mortality 1977-1981	1982	1983	1984	1985	1986	1987	1988
Nonpermit areas									
25	380-480	5.4	3	4	1	1	2	8	6
Permit areas									
25A	430	8.2	15	16	12	13	12	13	20
26B	210	5.2	4	9	7	4	5	15	9
26C	300-450	2.0	4	2	3	6	8	9	8
Subtotal	940-1090	15.4	23	27	22	23	25	37	37
Total	1,320-1,570	20.8	26	31	23	24	27	45	43

[a] These figures include reported mortality only; additional illegal take very likely took place within permit areas and was reported as taken outside permit areas.

STUDY AREA

GAME MANAGEMENT UNIT: 26A (53,000 mi^2)

GEOGRAPHICAL DESCRIPTION: Western North Slope

BACKGROUND

Densities of grizzly bears are believed to be stable in Subunit 26A. The highest and lowest densities occur in the foothills of the Brooks Range and the northern coastal plain, respectively. Interest in hunting bears has remained high among both subsistence and recreational hunters, and monitoring of population status and harvest trends should continue.

POPULATION OBJECTIVES

To maintain the grizzly bear population at present levels.

To minimize adverse interactions between grizzly bears and the public.

METHODS

Surveys and censuses for determining the population status of grizzly bears were not conducted during 1988. Results of prior studies conducted in the foothills of the Brooks Range have been reported in previous progress reports. Harvest data were compiled from sealing certificates to determine the location and sex-age composition of bears sealed during 1988.

RESULTS AND DISCUSSION

Population Status and Trend

Results of research conducted by Reynolds (1984) indicated that the grizzly bear population ranged in size from 645 to 780 bears during the late 1970's and early 1980's. Although current population data are lacking, the size of the population probably has not declined. Trent (1988) reported that permit-hunting restrictions initiated during 1977-78 appeared to have favorably affected populations in the Brooks Range and densities may be at relatively high levels, with respect to the carrying capacity of the habitat.

Population Composition:

The most recent population composition and productivity data are available from Reynolds (1984) for the Utukok and Kokolik drainages in the western portion of the subunit. Of the grizzly

bears ≥1 year of age approximately 40% were males and 60% were females. The sex ratio of cubs and yearlings was approximately 50:50. The mean litter size was 2.0 cubs, and the mean annual productivity was 0.50 cubs/year.

Mortality

Season and Bag Limit:

The subsistence hunting seasons in Unit 26A East (i.e., east of 159° west longitude) for residents of Anaktuvuk Pass only are from 1 September to 31 October and from 1 April to 31 May. The bag limit for thse hunts is 1 bear. The hunting seasons for resident, nonresident, and other subsistence hunters are from 1 September to 31 October and from 10 May to 31 May. The bag limit for resident and other subsistence hunters is 1 bear every 4 regulatory years. For nonresident hunters, the bag limit is 1 bear every 4 regulatory years by drawing permit only; 8 drawing permits are issued.

The open seasons in Unit 26A West (i.e., west of 159° west longitude) for subsistence, resident, and nonresident hunters are 1 September to 31 October and 10 May to 31 May. The bag limit for subsistence and resident hunters is 1 bear every 4 regulatory years. The bag limit for nonresident hunters is 1 bear every 4 regulatory years by drawing permit only; 22 permits are issued.

Human-induced Mortality:

Twenty-one bears were sealed from Subunit 26A during 1988. One bear was killed in defense of life and property, and the remainder were harvested by hunters. Three bears were killed in the spring near Eagle Creek in Subunit 26A West. Eighteen bears were killed in the fall; eight were harvested in Subunit 26A West and 10 from Subunit 26A East. Fifteen bears were males and the remainder were females.

The 1988 reported harvest of 21 grizzly bears is lower than the 26 reported for 1987 and higher than the 18 reported for 1986 (Table 1). Trent (1988) believed that the unreported harvest was substantial; he estimated the 1987 unreported harvest ranged from 38% to 54% of the reported harvest. In 1987 the estimated total harvest was 36-40 bears; in 1986, it was 33-38 bears.

Hunter Residency and Success. All 3 bears reported harvested during the spring of 1988 were taken by Alaska residents. During the fall, 5 bears were taken by residents and 12 were taken by nonresidents. Among the 8 bears taken by residents in 1988, four were taken by local residents who resided in or adjacent to Subunit 26A.

Natural Mortality:

No recent estimate of natural mortality for grizzly bears in Subunit 26A is available; however, Reynolds and Hechtel (1983) reported mortality rates among offspring accompanied by marked adult females in the western Brooks Range to be 44% for cubs, 9% for yearlings, and 14% for 2-year-olds during the period 1977-1981.

CONCLUSIONS AND RECOMMENDATIONS

Trent (1988) suggested that the maximum allowable sustained yield for Subunit 26A was approximately 26 to 31 bears; he assumed a maximum harvest limit of 4%, and a population size of 645 to 780 bears. Although the reported harvest of 21 bears is less than the harvest range suggested above, the actual harvest, including the unreported ones, was certainly greater than 21 bears. Because the actual harvest and population size are not known with certainty, I believe it is premature to conclude that overharvesting is occurring. If the reported harvest increases substantially in the future, additional hunting restrictions may be necessary.

Before the grizzly bear population in Subunit 26A can be effectively managed, the problem of noncompliance with hunting regulations and reporting requirements needs to be resolved. Trent (1985, 1988) discussed in detail the problem of non-reporting in previous progress reports. Many local residents are either unaware or unsupportive of the hunting regulations. Many local hunters consider seasons, bag limits, and tag fee requirements to be cumbersome and culturally inappropriate. Because most hunting of bears by local residents is opportunistic, hunters do not usually plan bear hunts; consequently, many do not purchase a license and tag before they harvest a bear. In order to effectively evaluate the size of the harvest, the subsistence bear regulations and reporting requirements need to be modified to accommodate local use patterns. Such regulatory changes should be accompanied by extensive public review. Trent (1988) indicated as well that modified regulations should apply to all of Unit 26, not just to Subunit 26A.

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Table 1. Reported harvest of grizzly bears in Subunit 26A, 1983-88.

GMU	Estimated population size	Harvest of 4%	Reported harvest					
			1983	1984	1985	1986	1987	1988
26A West	325-350	13-14	4[a]	10	3	5	15	11
26A East	330-430	13-17	11	12[b]	7	13	11	10
Total	645-780	26-31	15	22	10	18	26	21

[a] Includes 1 bear killed in defense of life or property.

[b] Includes 2 bears killed in defense of life or property and 1 killed for unknown reasons.

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