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BROWN/GRIZZLY BEAR

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Sid O. Morgan, Publications Technician
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STATE OF ALASKA
Steve Cowper, Governor

DEPARTMENT OF FISH AND GAME
Don W. Collinsworth, Commissioner

DIVISION OF WILDLIFE CONSERVATION
W. Lewis Pamplin, Jr., Director
Donald E. McKnight, Planning Chief

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Publications Technician
ADF&G, Wildlife Conservation
P.O. Box 3-2000
Juneau, AK 99802
(907) 465-4190

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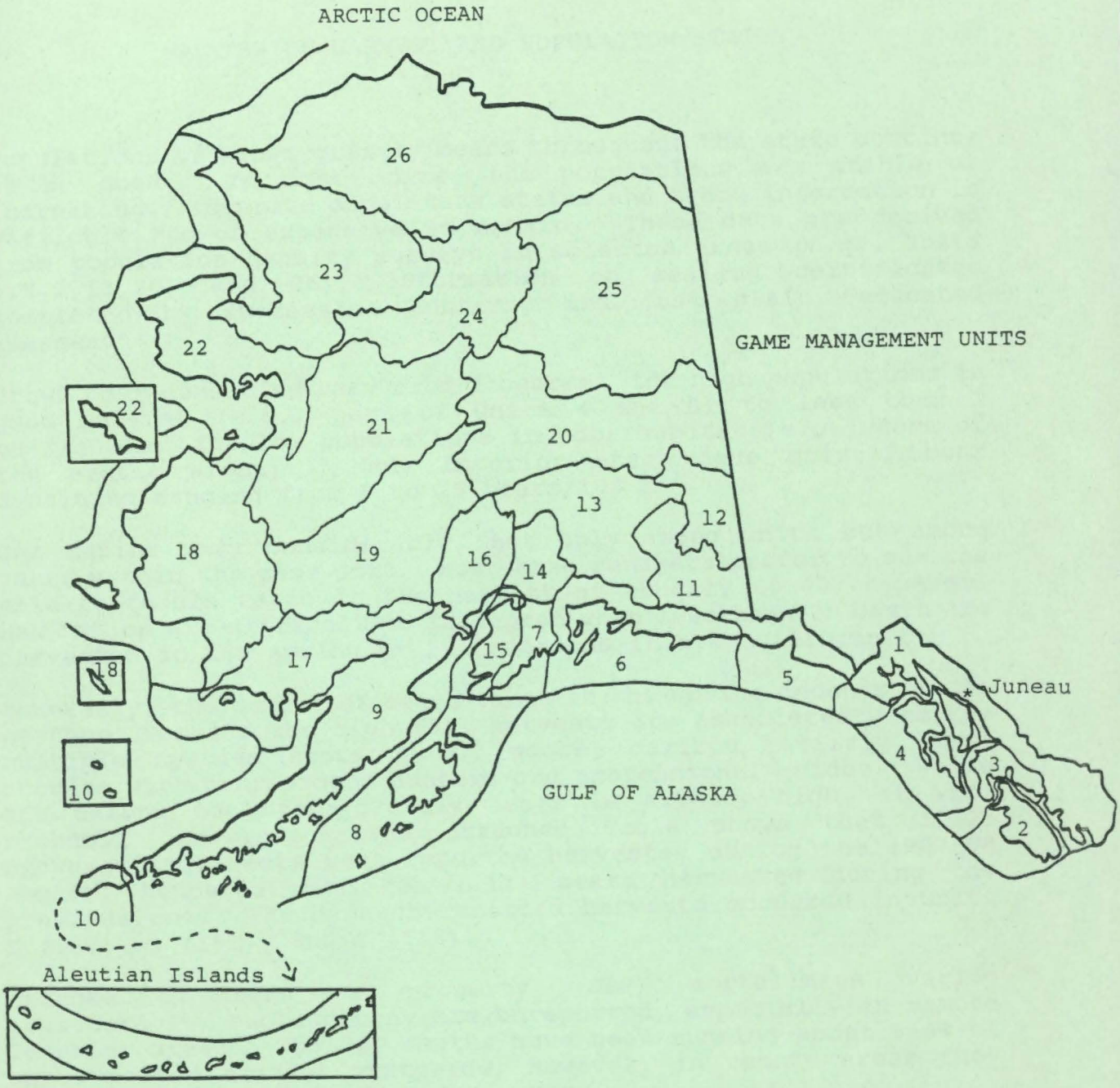
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STATEWIDE HARVEST AND POPULATION STATUS

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 and/or expensive to obtain. These data are derived from population density surveys in selected areas (e.g., Units 4,8,9,13,20, and 26), information on sealing certificates completed by successful hunters, and just plain "educated guesses."

Brown 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 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, 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 1,225 brown/grizzly bears were reported harvested during the 1987-88 season, compared with the 1,121 bears harvested during the previous one. The highest reported harvests occurred in Units 9 (262), 8 (151), and 4 (116).

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.

Unit	Bears harvested by hunters	Nonsport Mortality
1	22	0
4	116[a]	10
5	35[b]	2
6	49	6
7 & 15	12	1
8	151	23
9	262	0
10	8	--
11	7	--
12	20	1
13	104	3
14	9	--
16	93[c]	--
17	53[a]	2
18	5	--
19	36	--
20	63	5
21	6	1
22	42	7
23	35	2
24	22	2
25	24	3
26	51	1
Total	1225	69

[a] second highest on record
[b] highest on record
[c] equals previous record harvest

Steven R. Peterson
Senior Staff Biologist

STUDY AREA

GAME MANAGEMENT UNIT: 1 (16,950 mi²)

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 along the mainland coast (Unit 1) 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 1961 and insight gained from interviews with hunters have provided the basis for season and bag limit recommendations.

POPULATION OBJECTIVES

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

To reduce killing of brown bears because of garbage habituation.

METHODS

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

RESULTS AND DISCUSSION

Population Status and Trend

Population information is not available for brown bears in this unit. Information on hunter effort and success rates was not collected, making it difficult to ascertain population trends. However, harvest data suggest that the population is probably 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:

The harvest is summarized in Tables 1 and 2. Since 1974 the harvests from Subunits 1C and 1D have accounted for 25% and 41% of the Unit 1 total, respectively. A moderate increase in sport harvest for the unit has been evident. The average annual harvest from 1973 through 1982 (i.e., 16.2 bears) was eclipsed by the 1983-87 average (i.e., 21.2 bears). There was no apparent trend in the nonsport harvests.

In 1987 males made up 75% of the known-sex harvest, slightly higher than the 67.4% average for the previous 14 years. Sex ratios in the harvest fluctuated during the same period, while the mean of 67.4% males was well within the current management objectives.

Skull sizes have remained relatively constant for both males and females throughout the unit. Mean age of harvested males has increased slightly since the mid-1970's, while that for females has not changed (Table 1).

Hunter Residency and Success. Nonresident hunters accounted for 14% of the sport harvest in 1987, well below the 14-year average of 23%.

Harvest Chronology. Since 1974 the harvest has been split evenly between the spring and fall seasons (Table 3); however, in 1987 the fall harvest of 17 brown bears (77%) was markedly higher than the spring take of 5 brown bears (23%). While both the spring and nonresident harvests dropped substantially in 1987, the data indicate that the two are probably unrelated.

Transport Methods. There has been no significant changes in the methods of transportation reported by successful hunters. The majority of hunters in Subunits 1A, 1B, and 1C reached the hunting areas by boat, while hunters in Subunit 1D made frequent use of highway and off-road vehicles. Few road access opportunities exist, except in Subunit 1D.

Habitat Assessment.

Construction projects and increased human activity may have an impact on brown bear populations in the Berners Bay area as current mineral exploration and development continues. The impact of mining and associated activities on patterns of bear habitat use is being examined on nearby Admiralty Island (Schoen and Beier 1987).

CONCLUSIONS AND RECOMMENDATIONS

The management objectives regarding average age and sex ratios of harvested brown bear in Unit 1 have been easily met. The average age of harvested males for the last 5 years (1983-87) was 8.8, an increase over the previous 10-year average of 7.4 and well over the objective of 6.5 years. During the same period, the harvests and skull sizes have remained constant and the sex ratio of harvested bears has been within management guidelines.

Hunting pressure is expected to increase because of increases in human population. A recent decision by the Guide Board (i.e., limiting the number of guides in Unit 4) may also be conducive to increased use of Unit 1 by bear guides. Although we do not monitor hunting pressure or success rates, such information would allow more accurate assessment of population trends based on harvest data.

Efforts to reduce the number of bears that are destroyed because of garbage habituation are continuing. The Alaska Departments of Fish and Game, Public Safety, and Environmental Conservation, as well as the U.S. Forest Service, have recently developed a joint policy statement and action plan for solid-waste management that is expected to reduce future problems. Replacement of landfills with fuel-fired incinerators is one of the key provisions of the agreement. A strong public education program aimed at making residents, developers, and visitors aware of the consequences of habituating bears to human foods is being developed and implemented.

LITERATURE CITED

Schoen, J. W., and L. Beier. 1987. Brown bear habitat preferences and brown bear logging and mining relation ships in southeast Alaska. Fed. Aid in Wildl. Rest. Proj. W-22-4. 45pp.

PREPARED BY:

Thomas McCarthy
Game Biologist II

SUBMITTED BY:

David M. Johnson
Regional Management Coordinator

Table 1. Brown bear harvest parameters in Unit 1, 1982-1987.

Year	Sport harvest	Total harvest	Males (%)	Nonresident harvest (%)	Male skull size[b]		Age			
							Males		Females	
					x	n	x	n	x	n
1982	17	18	59	35	20.6	7	6.0	7	5.4	1
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

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

Table 2. Brown bear harvest[a] in Unit 1 by subunit.

Year	1A		1B		1C		1D		Total
	No.	% of total	No.	% of total	No.	% of total	No.	% of total	Unit 1
1982	2	11	4	22	6	33	6	33	18
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
mean	3.1	16	3.4	18	5	25	8.2	41	19.8

[a] Includes sport and DLP kills.

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

Year	Spring		Fall	
	Harvest	%	Harvest	%
1982	9	53	8	47
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

STUDY AREA

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

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

BACKGROUND

Brown bear are present on all of the larger islands in Unit 4. The average annual harvests there have increased since the bear sealing program began in the 1960's; the average annual harvests for the 1960's, 1970's, and 1980's were 55, 85, and 84 (thus far), respectively (Table 1). In 1976 the highest harvest ever recorded for Unit 4 was 142 bears. Brown bears are highly sought by nonresident hunters.

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 males:2 females.

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

METHODS

Successful brown bear hunters are required to present the head and hide to an ADF&G representative for sealing. Measurements are taken of the length and width of skinned brown bear skulls, a rudimentary premolar tooth is extracted, the hide is examined for evidence of sex, and other pertinent data are noted. Teeth are aged by counting cementum annuli.

An aerial brown bear census was conducted in the alpine zone on Admiralty Island (i.e., brown bear research study area) utilizing a Piper Supercub. A reduction in numbers of brown bears lost in defense of life or property (DLP) incidents was attempted through public education and interagency agreements.

RESULTS AND DISCUSSION

Population Status and Trend

Based on aerial census and hunter harvest data, brown bear populations on Admiralty, Baranof, and Chichagof Islands are thought to be stable. Five aerial surveys in the 150-mi) ADF&G research study area on Admiralty Island indicated a density of 0.96 bears/mi) in July 1987 and 1.06 bears/mi) in 1986 (J. Schoen, pers.

commun.). The Admiralty Island study area, which includes Greens Creek, Hawk Inlet, and Youngs Bay consists of excellent bear habitat, and populations are higher than on other islands in Unit 4.

Mortality

Season and Bag Limit:

The hunting season in the western portion of Unit 4 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:

Sport hunters harvested a total of 116 brown bears. The 1987 sport harvest was 20 more than the 1986 harvest of 96 and the 2nd-highest harvest on record. While many brown bear hunters select for large bears, regulations prohibit the harvesting of cubs or sows accompanied by cubs. This combination of regulatory requirements and hunter selectivity leads to a high proportion of males in the legal harvest.

In Unit 4 the 1987 legal sport harvest was composed of 76% males (n = 88), 22% females (n = 25), and 2% unspecified (n = 3), compared with 66% males (n = 63), 31% females (n = 30), and 3% unspecified (n = 3) in 1986 (Table 1). Variation in male skull sizes can be an indication of the degree of hunting pressure. A greater-than-average harvest should result in a reduction in skull sizes. In 1987 the average skull size of males increased from that in 1986, while the average female skull size decreased (Table 2). The average male skull measurement for Unit 4 was 22.8 inches for males (n = 85). Males harvested on Admiralty, Baranof, and Chichagof Islands averaged 22.4 (n = 38), 23.1 (n = 16), and 23.3 inches (n = 33), respectively. The age composition of brown bears harvested in 1987 is shown in Table 2. The oldest bear taken was 22.4 years; the youngest was 2.4 years. In 1987 the mean ages of sport-killed male and female brown bears was 8.2 (n = 85) and 6.9 (n = 23) years, respectively. An average of 36.2% cubs were observed in the Admiralty Island bear research area during aerial surveys conducted in July (J. Schoen, pers. commun.).

When the nonsport-killed bears are included, the harvest in 1987 was 126 bears: 25, 50, and 50 bears from Baranof, Chichagof and Admiralty Islands, respectively. One bear was also harvested on Kruzof Island. In 1986 hunters on Baranof, Chichagof, Admiralty, and Kruzof Islands harvested 12, 53, 33, and 2 bears respectively (Unit 4 total = 104 bears).

Ten DLP bears were reported in 1987, compared with five in 1986. Increased logging-related development on federal and private lands in Unit 4 provided access to interior island brown bear populations that had been formerly isolated from human contact. Brown bear harvest data will be examined annually to determine if there is

increased mortality from legal hunting and/or DLP incidents in roaded areas.

Improperly disposed garbage is an attraction to bears, often leading to destruction of the "nuisance" animal. A joint agreement was developed by the State of Alaska and the U.S. Forest Service (USFS) in 1987; the agreement is entitled "Solid Waste and Bears, A Joint Policy Statement and Action Plan For Southeast Alaska" (Appendix A), and if implemented, it should help reduce bear habituation problems. The interagency agreement addressess habitual bears as follows:

> 7. Bears currently habituated shall be handled on a case by case basis. Consideration of all viable options including destroying shall be included in revised plans for existing landfills.

This interagency bear policy lists many strategies to be used to help accomplish the objective. Replacing landfills with fuel-fired incinerators should be an effective tool in reducing DLP incidents.

Hunter Residency and Success. Alaska residents harvested 62 brown bears (53%) in Unit 4; nonresidents, 54 (47%) (Table 3). Successful residents reported hunting a total of 206 days (an average of 3.2 days each), while successful nonresidents reported a total of 261 days (an average of 4.8 days each) (Table 4).

Harvest Chronology. Most brown bear hunting in Unit 4 occurred in the spring (Table 5). Spring hunts accounted for 77 bears (66%); 39 bears (34%) were killed in the fall. A total of 64 bears (55%) were taken between 1 and 20 May. The chronology of the harvest has remained fairly consistent for the past 5 years, because the major harvest occurs after bears have left the dens and begun feeding on grasses and sedges on the beach.

Transport Methods. Boats were used more (74%) than any other transportation means by brown bear hunters in Unit 4, but use of land vehicles appears to be increasing yearly (Table 6). In 1987 land vehicle users harvested 14 brown bears (12% of the total harvest), compared with six (6%) in 1986, four (5%) in 1985, and two (2%) in 1984. Aircraft use did not exhibit an obvious trend.

CONCLUSIONS AND RECOMMENDATIONS

Unit 4 has the highest brown bear population and harvest in Southeast Alaska. A large portion of Admiralty Island was congressionally designated as a National Monument under the provisions of the Alaska National Interest Lands Settlement Act (ANILCA), partly because of its high brown bear population. There are 3 areas in Unit 4 that are closed to brown bear hunting: (1) the Seymour Canal Closed Area on Admiralty Island, which includes Pack Creek; (2) the Salt Lake Bay Closed Area at Mitchell Bay on Admiralty Island; and (3) the Port Althorp Closed Area on

Chichagof Island. Location descriptions can be found in the "Special Use Restrictions" of Alaska Game Regulations No. 28.

Two of the 3 management objectives were met during the reporting period. The average age of harvested males was 8.2 years, greater than the 6.5 years stated in the objectives. The harvest ratio was 3 males:1 female, which is greater than the minimum objective of 3 males:2 females. The 3rd objective was to reduce the loss of bears due to garbage habituation through development of joint policies and public education. While the DLP kills increased during the period, progress was made toward accomplishing the objective. An interagency joint policy statement and action plan (Appendix A) was signed in September 1987 by the Commissioner to help reduce nuisance bear problems and bear losses in Southeast Alaska. Wildlife Conservation Division should work with the Habitat Division to use that Department's permit review authority to bring logging camps and communities into compliance with the interagency joint policy statement. Interagency cooperative agreements between the Alaska Departments of Fish and Game and Natural Resources, as well as the U.S. Forest Service, will be completed in 1988 to establish policies for the brown bear observation area at Pack Creek. The area has grown in popularity each year, and the increase in visitors has been having a negative influence on bear use. Plans will include limitations on maximum visitor numbers, a permitting system, and the establishment of observation points. The intent is to create a system similar to the McNeil River State Game Sanctuary on the Alaska Peninsula.

We are concerned about the impact of roading on brown bears. In 1987, 14 brown bears were taken from land vehicles in Unit 4. All of the bears were killed near the Hoonah-Tenakee road system on Chichagof Island.

PREPARED BY:

Elroy L. Young
Game Biologist III

SUBMITTED BY:

David M. Johnson
Regional Management Coordinator

Table 1. Brown bear sport harvests in Unit 4, 1983-1987.

	Male				Female				Sex Unknown				
Year	Spring	Fall	Total	% total	Spring	Fall	Total	% total	Spring	Fall	Total	% total	Overall total
1983	42	21	63	78	5	12	17	21	0	0	1	1	81
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

Table 2. Average skull sizes[a] (inches) and ages of sport-killed brown bears in Unit 4, 1983- 1987.

	Skull sizes						Ages					
	Male		Female		Sex unknown		Male		Female		Sex unknown	
Year	average	(n)	average	(n)	average	(n)	average	(n)	average	(n)	average	(n)
1983	20.9	60	19.1	17	0.0	0	6.6	62	8.0	16	2.8	1
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

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

Table 3. Sport-killed brown bears by island and hunter residency in Unit 4, 1983-1987.

Year	Admiralty		Baranof		Chichagof		Kruzof		% total		Total Island Harvest
	Res	Nonres	Res	Nonres	Res	Nonres	Res	Nonres	Res	Nonres	
1983	16	22	9	7	13	14	0	0	47	53	81
1984	26	23	10	15	22	14	1	0	53	47	111
1985	8	18	9	13	20	20	0	0	42	58	88
1986	15	21	5	5	23	26	1	0	46	54	96
1987	22	24	12	13	27	17	1	0	53	47	116

Table 4. Total and average days hunted and residency of successful sport brown bear hunters in Unit 4, 1983-1987.

Year	Resident		Nonresident		Resident and nonresident	
	Total	Average	Total	Average	Total	Average
1983	142	3.7	216	5.0	358	4.4
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

Table 5. Chronology of sport-harvested brown bears in Unit 4 by week and hunter residency, 1983-1987.

Time Period	1983			1984			1985			1986			1987		
	R[a]	N[b]	T[c]	R	N	T	R	N	T	R	N	T	R	N	T
Spring:															
04/11-04/20	0	1	1	3	2	5	0	0	0	0	0	0	0	0	0
04/21-04/30	3	2	5	5	2	7	0	0	0	0	2	2	3	2	5
05/01-05/10	8	11	19	17	17	34	5	7	12	13	13	26	13	10	23
05/11-05/20	9	9	18	12	8	20	8	18	26	14	13	27	23	18	41
05/21-05/31	1	3	4	3	7	10	1	6	7	2	8	10	0	8	8
Fall:															
09/11-09/20	5	9	14	4	9	13	7	10	17	3	10	13	1	7	8
09/21-09/30	1	6	7	6	5	11	8	9	17	0	6	6	3	9	12
10/01-10/10	6	1	7	0	2	2	1	1	2	2	0	2	5	0	5
10/11-10/20	3	1	4	4	0	4	3	0	3	5	0	5	6	0	6
10/21-10/30	1	0	1	3	0	3	2	0	2	2	0	2	5	0	5
11/01-11/10	1	0	1	0	0	0	1	0	1	1	0	1	3	0	3
11/11-11/20	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0
11/21-11/31	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0
12/01-12/10	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Totals	38	43	81	59	52	111	37	51	88	44	52	96	62	54	116

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

Table 6. Transportation means used by successful brown bear hunters in Unit 4, 1983-1987.

Transportation means	1983	1984	1985	1986	1987
Airplane	8	15	5	7	13
Boat	70	94	78	81	84
Vehicle (logging roads)	1	2	4	6	13
Walked (logging roads)	0	0	0	1	1
Vehicle (existing highways)	1	0	0	0	1
Unknown	1	0	1	1	2
Total	81	111	88	96	114

STUDY AREA

GAME MANAGEMENT UNIT: 5 (6,235 mi²)

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

BACKGROUND

Brown bears probably first occurred on the Yakutat and Malaspina Forelands following the retreat of ice (i.e., 300 to 500 years ago). Like other wildlife, brown bears gained access to the eastern Gulf Coast by moving from the interior of Alaska and Canada via the Alsek-Tatsenshini corridor.

Since 1961, when brown bears were first sealed in Alaska, 502 sport-killed bears have been sealed from Unit 5. Sixty-four percent of these bears were males, and 55% were harvested by nonresident hunters. An additional 47 nonsport bears have been taken in this same period. The hunting of brown bears by guided nonresidents in this unit has been fairly consistent throughout the years. Since 1979 this interest has been stable, judging by the percentage of nonresident harvests.

POPULATION OBJECTIVES

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

METHODS

Most data were gathered from the sealing records of brown bear hides by Department and Fish and Game and Division of Fish and Wildlife Protection staff. State game regulations require that brown bears must be sealed within 30 days of harvest. The skull is measured, and a rudimentary premolar tooth is extracted for age determination. Additional information is obtained from the hunter; e.g., location of harvest, transportation method, number of days hunting, guide information, etc. Other information collected includes incidental observations of bear dens that were noted during aerial surveys of mountain goats and anecdotal information from hunters.

RESULTS AND DISCUSSION

Population Status and Trend

Precise population information is not available for brown bears in Unit 5. Data gathered from sealing certificates, incidental observations, and hunter interviews suggest that the population is probably stable.

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 in Unit 5 have increased over the last 2 decades. The average harvest from 1971 to 1980 was 21 bears (range = 13-28), while the 1981-87 mean harvest was 33 bears (range= 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 1981-87 average was 6.7 years. Mean male skull dimensions remained constant. For the 1971-80 and 1981-87 periods, the average measurements were 20.1 and 20.6 inches, respectively.

The reported harvest of 37 bears in 1987, including 2 nonsport mortalities, was the highest on record. While it remains speculative, this level of harvest is probably due, in part, to higher hunter effort. Some of this increased harvest may have been due to higher visibility of bears in Russell-Nunatak Fjords. During the summer of 1987, the blockage of these fjords by the advancing Hubbard Glacier caused the vegetation there to be inundated by salt water and subsequently killed.

Hunter Residency and Success. From 1983 to 1987, the number and percentage of brown bears taken in Unit 5 by nonresident hunters were very consistent. Their harvest has ranged from 19 to 23 bears (mean = 21), representing 66-77% of the total harvest (mean = 69).

Harvest Chronology. Before 1984 spring bears composed 56% of the annual harvest, but from 1983-1987 that average dropped to 39%. This change appears to be correlated to the increased total harvest since 1980, most of which has occurred during the fall season.

Transport Methods. Consistent with previous years, aircraft provided access to hunting areas for about 50% of the successful hunters in 1987, while boats and highway vehicles were used by the remainder.

CONCLUSIONS AND RECOMMENDATIONS

Management objectives for brown bears in Unit 5 were exceeded in 1987. The mean age of male bears was 7.0 years, compared with our 6.5-year objective. The harvest ratio was 3.2 males:2 females, compared with the 3 males:2 females ratio identified in the population objectives.

Both black and brown bears are viewed as pests, rather than as valuable resources by residents of Yakutat. The Yakutat dump has been an attractant to 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 to properly manage garbage.

The implications of the increased fall harvest (i.e., both in number and percentage of the total annual harvest) should be considered in future management decisions. Preliminary data show the harvest in the spring of 1988 was the lowest since 1974; therefore, the population trends in this population of bears should be closely monitored. The number of guided bear hunts increased beginning in 1984 (Table 2); this factor may partially explain the higher fall harvest since that time. It can be speculated that increased fall harvests have reduced bear numbers in high-density areas. If age and skull size paramaters show declining trends or the harvest ratio decreases below 3 males:2 females, reduced harvest levels may become necessary.

PREPARED BY:

Bruce Dinneford
Game Biologist III

SUBMITTED BY:

David M.Johnson
Regional Management Coordinator

Table 1. Brown bear harvest, ages, and skull sizes in Unit 5, 1983-87.

Year	M	F	Unk.	Total	M	F	Unk.	Total	Mean skull size inches M	F	Unk.	Total	Avg. days per harvest (Successful Hunters) M	F	Unk.
1983	21.0	11.0	1.0	33.0	5.9	7.6	2.8	6.4	21.9	20.8	18.9	21.4	5.0	8.0	3.0
1984	25.0	10.0	1.0	36.0	7.5	5.1	4.4	6.7	22.8	19.9	22.9	22.0	5.0	5.0	--
1985	17.0	12.0	1.0	30.0	5.8	7.4	10.8	6.6	21.3	21.3	22.3	21.8	5.0	4.0	1.0
1986	20.0	10.0	0.0	30.0	7.6	5.6	--	6.9	23.4	20.1	--	22.4	4.0	7.0	--
1987	23.0	14.0	0.0	37.0	7.0	6.8	--	6.3	22.8	20.9	--	22.0	4.4	4.8	--

Table 2. Guided brown bear hunts in Unit 5, 1978-1987[a]

Year	Numbers of hunts per guide						Total
	Guide 1	Guide 2	Guide 3	Guide 4	Guide 5	Guide 6	
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	5	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
Total	23	100	66	52	129	42	412

[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 all islands west of Montague Island and Valdez Arm. Brown bears are rare or absent on the mainland in the portion of Subunit 6D west of Columbia Glacier. Brown bear distribution in Subunit 6D has apparently changed little from that observed in 1908 by Heller (1910). Brown bears in Unit 6 seasonally utilize virtually all available habitat types.

The role of brown bears as predators on dusky Canada geese on the west Copper River Delta (Subunit 6C) was investigated between 1984 and 1987 (ADF&G files), providing information on denning locations and timing, seasonal habitat utilization, and home ranges. Observations during May 1986 suggested that the density of brown bears on the Delta was 1 bear/3.3-4.6 mi^2 (Campbell and Griese 1987).

The management goal for brown bears in Unit 6 has been to provide an opportunity to hunt brown bears under aesthetically pleasing conditions. However, because of evidence that (1) brown bears substantially affect both dusky Canada goose and moose production and (2) the brown bear population is increasing, management goals for Subunits 6B and 6C were modified in 1987 to provide the greatest opportunity to hunt for brown bears as well as an optimum harvest. In effect, hunters were encouraged to select Subunits 6B and 6C as hunt areas.

The reported mean annual harvest of brown bears in Unit 6 between 1961 and 1986 can be characterized as follows: (1) annual harvest of 34; (2) sex composition of 59% males, 37% females, and 4% unknowns; (3) 57% of the sport harvest occurring in the spring; (4) 47% of all bears from Subunit 6D, 26% from Subunit 6A, 15% from Subunit 6B, and 11% from Subunit 6C; (5) the mean annual skull size of sport-killed male bears of 23.4 inches; (6) nonresident hunters accounted for 42% of the sport harvest; and (7) 59% of successful hunters using airplanes for transportation to their hunt area, 17% used boats, and 24% other forms.

The greatest future impact on brown bear abundance and distribution will be loss of habitat and human encroachment. Timber harvest 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 clearcut. 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 increasing remote settlements will also encroach on bear habitat and increase harvest pressures.

POPULATION OBJECTIVES

To maintain a brown bear population that will sustain an annual harvest of 35 bears composed of at least 60% males and a minimum average skull size of 23 inches.

METHODS

The sealing by a Department official of the hide and skull from all brown bears killed in Unit 6 is mandatory. Each hide is checked for sex identifiers, skulls are measured, and a rudimentary premolar tooth is extracted for age assessment. Hunters are asked to report on date of harvest, days hunted, location of harvest, and type of transportation used to access the hunt area.

In May 1987, 16 bears were translocated from the Copper River Delta in Subunit 6C to the drainages of the Kaliakh and Ducktoth Rivers in Subunit 6A, as part of an experiment (Campbell and Griese 1981) to temporarily reduce the predatory effects of brown bears on nesting dusky Canada geese. Methods for capturing, translocating, and radio-collaring the bears and the effect of the translocation on goose nesting success were described by Campbell et al. (1988). A paper describing resulting movements and fate of the translocated bears will be submitted for publication to the Wildlife Society Bulletin or the Journal of Mammalogy (Appendix A).

RESULTS AND DISCUSSION

Population Status and Trend

The brown bear population of the last 5 years has been at a high level, perhaps the highest since the early 1900's. Nevertheless, brown bear numbers on Montague Island were lower in 1987-88 than during the period prior to the 1964 earthquake. Reduced salmon populations and heavy hunting pressure may have stabilized that population at a low level.

Population Size:

Campbell and Griese (1987) estimated the populations in Subunits 6B and 6C at 85-120 and 60-86 bears, respectively. These estimates were based on brown bears observed on the west Copper River Delta during May and June 1984, 1985, and 1986.

Population Composition:

The observed age composition of brown bears utilizing the west Copper River Delta (Campbell and Griese 1987) ranged from 66% to 83% $\geq$ 2 years, 9% to 21% yearlings, and 6% to 12% cubs-of-the-year. Campbell et al. (1987) suggested that the observed

composition on the Delta was biased against breeding adults. It also appears that family groups with cubs-of-the-year were also underrepresented. During the same study, observed sex composition for brown bears ≥ 2 years averaged 31% males, 42% females, and 28% unknown.

Mortality

Season and Bag Limit:

The open season for resident and nonresident hunters in Unit 6 is 1 September to 31 May. The bag limit is 1 bear per 4 regulatory years, except that cubs and females accompanied by cubs may not be taken.

Human-induced Mortality:

Sealing records indicated that 55 brown bears were killed during 1987, representing the 3rd-highest harvest since 1961 and equaling the harvest of the previous year (Table 1). The number of brown bears killed in 1987 was 62% above the 1961-68 annual mean of 34.

The 1987 harvest was composed of 33 (60%) males, 21 (38%) females and 1 (2%) unknown. This composition was derived from 49 sport-killed, 1 illegally killed, 1 fatally wounded, and 4 defense-of-life-or-property (DLP) brown bears. Sex composition of sport-harvested bears was similar to that for the previous 25 years. The sex composition of the 6 nonsport-killed bears follows: 4 (67%) females, 1 (17%) males, and 1 (17%) unknown.

The mean skull size of male brown bears killed in Unit 6 in 1987 was 23.2 inches (n = 31). The mean skull sizes of brown bears harvested in the 1960's, 1970's, and 1980's were 23.8 (n = 101, 23.1 (n = 165), and 23.0 inches (n = 166), respectively.

Forty-seven percent of sealed brown bears came from Subunit 6D, 31% from Subunit 6A, 13% from Subunit 6B, and 11% from Subunit 6C. Record harvest levels for individual recording areas (Table 1) occurred in the Bering River-Controller Bay area of Subunit 6A and the Port Gravina-Port Fidalgo area of Subunit 6D. For the first time in 27 years, no brown bears were reported killed on Montague Island, an area that historically has provided 16% (5.4 bears) of the in Unit 6.

Hunter Residency and Success. In 1987 nonresident hunters harvested 26 brown bears, accounting for 53% of the total sport harvest. Nonresident hunters accounted for 71% of the spring harvest and 36% of the fall harvest.

Harvest Chronology. In 1987 hunters killed 24 (49%) brown bears during the spring and 25 (51%) during the fall.

Game Board Actions and Emergency Orders

At the recommendation of Division staff, the Board lengthened the spring hunting season by 6 days for the 1987-1988 regulatory year. The spring season was extended in response to apparently increasing brown bear populations throughout most of the unit and suspected low harvest rates for the Copper River Delta, where bear predation on dusky Canada goose nests was significant (Campbell and Griese 1987). The length of the effective spring season (i.e., measured from 1 April, because no brown bear has ever been killed in Unit 6 prior to that date) has varied from 91 days in 1961 to 16 days in 1971 to 55 days from 1981 to 1987. The additional 6 days provided a total of 61 days for the effective spring season. The fall season (i.e., ending November 30) has remained unchanged at 91 days since 1985. In 1968 the Board reduced the bag limit from 1 bear per regulatory year to 1 bear every 4 regulatory years.

CONCLUSIONS AND RECOMMENDATIONS

Population objectives were attained or exceeded for 1987. Maintaining our objectives will depend on our ability to educate hunters on how to select for adult male bears and provide ample protection from human encroachment and habitat destruction.

Brown bear harvests did not seem to increase in Subunits 6B and 6C, despite efforts to increase hunter interest. In 1987, 11 brown bears were killed by hunters in these subunits, excluding one from Subunit 6C killed by a hunter in Subunit 6A only 4 months after the Department had translocated it (Appendix A). This harvest level was not substantially higher than the previous 26-year mean of 9 bears. We did not measure hunting effort, but commercial guides increased their effort slightly.

While it appears that bear populations are increasing or stable over most of the unit, the Montague Island population is not following this trend. I recommend that efforts be expended to assess relative bear densities on Montague Island. Impending timber sales by private and federal land managers on the island will remove substantial quantities of forest habitat and facilitate improved access for a greater number of hunters. It will be necessary to anticipate bear hunter demands and modify regulations to maintain a desired bear density under these changing conditions.

I further recommend that research effort be directed at assessing the impacts of clearcutting large tracts of timber in Unit 6. Until such an assessment is completed, anticipating impacts of timber harvest on brown bear populations will have to be drawn from results of studies conducted in Southeast Alaska by Schoen and Beier (1987). However, differences in habitat distribution and quality between Southeast Alaska and Unit 6 may cause significantly different impacts on brown bear.

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PREPARED BY:

Herman Griese
Game Biologist III

SUBMITTED BY:

Lawrence J. Van Daele
Survey-Inventory Coordinator

Table 1. Brown bear harvest by subunit in Unit 6, 1961-87.

	Number of bears sealed[a]												
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
6A													
Icy Bay-Ragged Mtns.													
Yakutaga	3	3	1	1	0	0	2	0	3	5	0	1	5
Bering Glacier	0	5	0	0	0	7	4	4	1	5	2	1	8
Bering River-Controller Bay	0	0	0	2	1	1	6	5	0	2	1	2	4
Kayak Island	0	0	0	0	0	0	2	1	0	0	0	0	0
Katalla River	0	1	0	1	0	3	1	2	0	0	0	1	1
Nonspecific 6A	0	0	0	0	0	0	0	4	0	0	0	1	0
Subtotal 6A	3	9	1	4	1	11	15	16	4	12	3	6	18
6B													
Ragged Mtns - Copper R.	0	5	6	6	6	0	4	7	3	3	5	6	8
6C													
Copper R.- Cordova	3	1	2	1	9	6	8	8	6	2	2	4	3
6D													
Prince William Sound													
Nelson Bay-Sheep Bay	0	1	0	4	5	4	1	2	0	1	0	2	3
Port Gravina-Port Fidalgo	1	0	2	0	0	4	3	7	2	4	4	2	1
Valdez Arm	0	0	2	2	3	3	5	3	1	0	0	4	2
Montague Island	4	1	12	6	5	6	15	15	5	3	6	11	2
Hinchinbrook Island	1	6	6	9	5	4	9	5	3	2	1	6	1
Hawkins Island	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
Nonspecific 6D	0	0	0	0	1	0	0	0	0	0	0	0	0
Subtotal 6D	6	8	22	21	19	21	33	32	11	10	11	25	9
Nonspecific Unit 6	0	0	0	0	0	1	2	1	0	1	0	0	0
Unit 6 Total	12	23	31	32	35	39	62	64	24	28	21	41	38

Table 1. Continued.

Unit/Area	Number of bears sealed[a]													
	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
6A														
Icy Bay-Ragged Mtns.														
Yakataga	0	0	2	3	2	1	1	0	1	4	2	5	3	2
Bering Glacier	5	2	0	5	3	2	5	2	0	2	4	6	3	5[b]
Bering R.-Controller Bay	4	5	2	0	4	4	3	2	1	1	6	4	4	7
Kayak Island	0	0	0	1	0	1	0	2	0	1	0	2	0	1
Katalla River	0	1	1	0	1	1	0	0	3	1	0	5	2	2
Nonspecific 6A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal 6A	9	8	5	9	10	9	9	6	5	9	12	22	12	17
6B														
Ragged Mtns.-Copper R.	3	8	5	3	4	3	6	5	9	9	4	3	11	7
6C														
Copper R.-Cordova	1	3	6	2	3	3	2	1	4	5	7	2	5	4
6D														
Prince William Sound														
Nelson Bay-Sheep Bay	2	0	1	1	2	1	0	3	1	1	1	0	2	4
Port Gravina-Port Fidalgo	4	2	4	4	1	2	3	0	1	8	5	8	5	11
Valdez Arm	0	2	1	2	2	3	1	2	2	0	4	0	2	5
Montague Island	8	2	1	5	5	2	1	1	2	4	3	3	12	0
Hinchinbrook Island	7	3	5	11	2	2	6	1	5	3	3	4	6	7
Hawkins Island	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Western FWS	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Nonspecific 6D	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal 6D	21	10	12	23	12	10	11	7	12	16	16	15	27	27
Nonspecific Unit 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unit 6 Total	34	29	28	37	29	25	28	19	30	39	39	42	55	55

[a] Includes sport harvest, illegal and defense of life or property killed bears.
[b] Includes 1 adult male from Subunit 6C translocated in May 1987 and killed by hunter in September 1987.

APPENDIX A.

HOMING OF TRANSLOCATED BROWN BEARS IN COASTAL, SOUTH CENTRAL ALASKA

Herman J. Griese, Alaska Dept. of Fish and Game
P. O. Box 669, Cordova, Alaska 99574

Bruce H. Campbell, Alaska Dept. Fish and Game
333 Raspberry Road, Anchorage, Alaska 99518

Abstract: In May 1987, 16 brown bears (Ursus arctos) were translocated from the west Copper River Delta approximately 150km east to the Kaliakh- Ducktoth River drainages. Fourteen bears were fitted with breakaway radio collars, and 9 bears provided homing success data. Overall homing success within the 6-month time frame of this investigation was 67%. Observed homing success for 5 males and 4 females was 40% and 100%, respectively. The maximum observed return rate was 9.7km/day for an adult male. Seventy-seven percent of all bears displayed an initial homing move. Ability to effec tively and permanently translocate bears was not supported by the results, however, this translocation successfully reduced brown bear densities on the Copper River Delta for a minimum average of 29 days.

Key Words: Alaska, brown bear, homing, movement, radiotelemetry, translocation, Ursus arctos.

STUDY AREA

GAME MANAGEMENT UNITS: 7 AND 15 (10,038 mi²)

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, they have been displaced from some regionally important habitats (i.e., the lower portions of many salmon spawning rivers along Cook Inlet's east shore). Field observations from many different sources and analysis 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 spawning in numerous streams in this region provide them 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 already completed a baseline inventory of salmon spawning streams and high-use brown bear areas on the Kenai Peninsula (Bevins et al. 1984, Risdahl et al. 1986), and its members are currently drafting an interagency brown bear management plan for this region.

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 Kenai Peninsula brown bear abundance are based on known distributions, impressions of relative local abundance, and estimates of density in other parts of Alaska. A point estimate of population size is derived from a density of 1 brown bear/15 mi² over 3,750 mi² 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 harvested brown bears supplement the Department's assessment of the status of the population.

RESULTS AND DISCUSSION

Population Status and Trend

Data are insufficient to assess the current trend in the brown bear population.

Population Size:

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

Mortality

Season and Bag Limit:

The open seasons in Units 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. Taking of cubs and females accompanied by cubs is prohibited.

Human-induced Mortality:

In 1987 the total reported harvest was 13 brown bears, including 12 sport-harvested (Table 1) and 1 nonsport-harvested brown bear. Sex composition of the sport harvest was 8 males and 4 females. Mean ages of males and females were 7.4 (n = 8) (range = 2.4-25.4 yrs) and 7.0 years (n = 3) (range = 2.8-9.8 yrs), respectively. The sport harvest was composed of 4 bears killed in the spring and eight in the fall. The nonsport harvest occurred under the state's defense of life or property (DLP) code (5 AAC 92.410) at mile 15.5 of the Hope Road (Unit 7); sex and age of that bear were not determined.

Mean annual reported brown bear harvests (i.e., sport and nonsport harvests) have increased at the linear rate of 2.2 bears/5-year period, beginning with the 1961-64 period (Fig. 1); the most rapid increase has occurred since 1980 (Table 2). The current 3-year annual mean reported harvest is 16 brown bears, compared with 13 bears harvested annually during the 1980-84 period. Since 1980 sport harvests have composed 82% of the total reported harvest (Table 2).

Historically, 50% of the Kenai Peninsula brown bear harvests have been females (Table 3). Since 1980 females have composed 52% of the total bear harvest, and they have outnumbered males in the harvest during 5 of the past 8 years. The percentage of males in the harvest has gradually declined since the Department first began

keeping harvest records in the 1960's (Table 3). The current 3-year-cumulative harvest consists of 48% males, compared with the Department's population objective of a harvest consisting of at least 60% males.

The historical age structure of the male harvest is characterized by a high proportion of s4.8-year-old brown bears (i.e., 59% since 1970) and the regular occurrence of ≥20-year-old bears (Table 4). Similarly, female harvests have contained a high proportion of ≤4.8-year-olds (i.e., 49% since 1970); however, in contrast to males, the oldest reported female was 17.4 years old and only 3 females r15 years old have been harvested since 1965.

Fall harvests (i.e., 1 Sept-15 Oct) have accounted for 73% (n = 67) of the cumulative sport harvest since 1980. Furthermore, 48% (n = 45) of these harvests have coincided with the Kenai Peninsula's moose seasons during the past 8 years (i.e., 1-10 Sept or 1-20 Sept in Unit 7 and 1-20 Sept in Unit 15). The cumulative sport harvest of female brown bears during the 20-day general moose season was 3 times greater than that during the 25-day remainder of the fall season (Table 5). Since 1980 the cumulative sport harvest has been 18 (19%) and 76 (81%) brown bears in Unit 7 and 15, respectively; the cumulative sport harvest in Unit 15 has been 20 brown bears in Subunit 15A, 23 bears in Subunit 15B, and 32 bears in Subunit 15C.

Hunter Residency. Resident hunters have taken 91% (n = 85) of the sport- harvested brown bears since 1980. In 1987, 83% (n = 10) of the sport harvest was taken by residents.

CONCLUSIONS AND RECOMMENDATIONS

The current harvest of Kenai Peninsula brown bears may be nearing or exceeding the population's sustained yield. Under current regulations, historical harvest data suggest that reported harvests will continue to increase in this region through the next decade (Fig. 1). Miller (1988) used computer simulation to derive an estimate of annual sustainable harvest rates for a brown bear population in Unit 13. He estimated that 8% of the bear population >2 years old or 5.6% of the total population could be removed annually on a sustained basis. Given an estimated population size of 250 brown bears on the Kenai Peninsula and a 3-year-mean reported harvest of 16 bears, the estimated annual human-inflicted mortality rate for this population has been 6.4%. This exceeds the sustainable harvest rate estimated by Miller (1988), without consideration for crippling losses or other unreported mortalities. I assume that there is very good compliance with the brown bear sealing requirement on the Kenai Peninsula; however, some unreported human-inflicted deaths occur each year.

The relatively low and decreasing percentage of males in the reported harvest also needs to be addressed (Table 3). An annual brown bear harvest containing less than 60% males and/or a declining percentage of males may be interpreted as indicators of

excessive harvest (Bunnell and Tait 1981). Accordingly, the Department's objective for Kenai Peninsula brown bears is to maintain a population that will support a harvest consisting of at least 60% males. As previously discussed, Kenai Peninsula brown bear harvests have historically contained a relatively high proportion of females or low proportion of males (i.e., 50% males). A plausible explanation for this trend is that Kenai Peninsula brown bear hunters are typically opportunistic and do not select for "large-bodied" or "trophy-size" bears. The chronology and age structure of fall sport harvests further support the hypothesis that many brown bears are incidentally killed during moose hunts; however, it does not explain the decreasing proportion of males in the harvest since 1960. It is reasonable to assume that this latter trend (1) is correlated to the increasing harvest pressure that has occurred over the past 2 decades and (2) reflects the lower availability of males in the population.

It is recommended that the annual reported brown bear harvest from all human-induced sources not exceed 5.6% of the estimated bear population (i.e., equivalent to 14 or fewer bears per year). Measures to reduce bear harvests, particularly the harvest of females, should be implemented, if the upward trend in reported annual bear harvests continues or the proportion of males in the harvest does not increase to 60%.

Harvest chronology patterns suggest that the most practical way to reduce the harvest and the proportion of females in the sport harvest to desired levels would be to reduce or eliminate the existing overlapping of moose and brown bear seasons. In the past, the fall brown bear and moose seasons have coincided as a convenience to hunters who were interested in incidentally killing a bear during their moose hunt. Since 1980, 48% ($\underline{n}$ = 45) of all brown bear sport harvests, or 5.6 bears/year, have been taken during the general moose seasons.

A late-September and October, nonoverlapping brown bear season would most likely attract hunters who are specifically interested in killing a "large-bodied" or old-aged bear. Assuming a normal age distribution and a lower vulnerability for adult bears, this factor alone should result in a reduction in the number of bears taken in the fall sport harvest. Furthermore, analysis of the temporal distribution of fall sport harvests (Table 5) suggests that significantly fewer females would be killed during a late-September and October bear season. A secondary benefit of a later fall season would be the harvesting of bears with prime pelts.

A potential disadvantage of a nonoverlapping season is that it may increase the take of DLP bears during the general moose season, since some conflicts between moose hunters and bears have been previously resolved by killing problem brown bears as game (i.e., with an Alaska sport hunting license and brown bear tag).

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PREPARED BY:

David A. Holdermann
Game Biologist II

SUBMITTED BY:

Lawrence J. Van Daele
Survey-Inventory Coordinator

Table 1. Summary of Kenai Peninsula reported harvests of brown bears by unit, 1980-87.

	Unit 7			Unit 15			
	Males	Females	Unknown	Males	Females	Unknown	Total
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
Totals	6	9	2	37	37	2	93

Table 2. Reported and mean harvests of Kenai Peninsula (Units 7 and 15) brown bears by 5-year intervals from 1961-64 through 1985-87.

5-year Interval	Sport harvest				Non-sport harvest				Mean annual reported harvest	Total reported harvest
	No. males	No. females	No. unk	Total	No. males	No. females	No. unk	Total		
1961-1964[a]	8	9	--	17	--	--	--	--	4	17
1965-1969	18	13	--	31	5	4	--	9	8	40
1970-1974	15	13	--	28	3	5	--	8	7	36
1975-1979	17	10	--	27	4	10	2	16	9	43
1980-1984	21	28	2	51	7	7	--	14	13	65
1985-1987[b]	21	19	2	42	2	2	1	5	16	47
Totals	100	92	4	196	21	28	3	52	57	248

[a] data for 4 years, no data available for 1960.
[b] data for 3 years, 1985, 1986, and 1987.

Table 3. Sex composition in the total reported Kenai Peninsula brown bear harvest[a] by 10-year intervals since 1961.

10-year Interval	Males n	%	Females n	%	Total
1961-1969	31	54	26	46	57
1970-1979	39	51	38	49	77
1980-1987	51	48	56	52	107

[a] includes known sex in harvest and nonsport harvests.

Table 4. Age characteristics of the total reported Kenai Peninsula brown bear harvest[a] by 5-year intervals since 1965.

5-year Interval	Males							Females						
	Mean Age		≤-4.8 Years		≥-15.0 Years			Mean Age		≤-4.8 Years		≥15.0 Years		
	n	x	n	%	n	%	Range	n	x	n	%	n	%	Range
1965-69[b]	10	10.4	4	40	3	30	2.8-24.8	8	6.8	3	38	0	--	2.8-13.8
1970-74	13	5.3	9	69	1	8	1.8-16.8	14	6.7	7	50	0	--	1.8-13.8
1975-79	20	6.5	14	70	4	20	0.8-21.8	16	6.5	7	44	0	--	2.8-14.8
1980-84	27	8.0	12	44	6	22	1.8-25.4	32	5.8	19	59	2	6	1.8-17.4
1985-87	21	8.4	13	62	4	19	1.8-28.8	18	7.5	6	33	1	6	2.8-15.8
Totals and Means	91		52	57	18	20	0.8-28.8	88		42	48	3	3	1.8-17.8

[a] includes sport harvests and nonsport harvests.
[b] bear ages not determined between 1961 and 1964.

Table 5. Comparison by sex of the fall brown bear sport harvest during and after the Kenai Peninsula general moose season, 1980-87.

Sex	01-20 Sept. (during)	21 Sept.-15 Oct. (after)	Total
Male	17	11	28
Female	28	9	37
Totals	45	20	65

STUDY AREA

GAME MANAGEMENT UNIT: 8 (8,750 mi²)

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 great demand by both Alaskan resident and nonresident hunters. Permit hunts have been in effect since 1968, and permit numbers have been limited in most areas since 1975. Annual sport harvests have ranged from 124 to 191 bears (mean = 154.1) from 1978 to 1987.

POPULATION OBJECTIVES

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

METHODS

Aerial sex and age composition surveys are flown annually on selected salmon streams on southwestern Kodiak Island by U. S. Fish and Wildlife Service (USFWS) personnel. A research project on the effects of the Terror Lake hydroelectric power development on brown bears was conducted from 1982 to 1986 (Smith and Van Daele 1988). The USFWS conducted a study on habitat use and evaluation of aerial brown bear survey techniques from 1983-1987 and a final report is being prepared. A brown bear density estimate was obtained in 1987 on 2 study areas on Kodiak Island (Barnes et al. 1988), using a mark-recapture technique that employed radiotelemetry and an aerial census (Miller et al. 1987). Harvest data were collected from mandatory hunter reports and the hide and skull sealing program. Hunting was monitored in the field by staff patrolling in boats and aircraft.

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 obtained in 2 study areas on Kodiak Island in 1987 (Barnes et al. 1988). In a 137-mi² area on northwestern Kodiak Island, including Terror, Kizhuyak, and Viekoda Bay drainages, an estimate of 78.5 independent bears (excluding dependent young) was derived, using the bear-days estimator developed by Miller et al. (1987). For a 244-mi² area on southwestern Kodiak Island, including portions of the Sturgeon, Ayakulik, and Red Rivers and Frazer, Red, and Akalura Lake drainages, an estimate of 134.4 independent bears was obtained. The densities in the 2 areas were essentially identical: 0.57 bears/mi² and 0.55 bears/mi², respectively.

Using the density estimator derived for the 2 study areas for a baseline, a tentative estimate of the brown bear population in Unit 8 was made. By subjectively rating brown bear densities in 31 subdivisions according to relative similarity in habitat to the 2 study areas, a population estimate of 1,928 independent bears was made. For the 4,810 mi² of brown bear habitat, the mean density was 0.4 independent bears/mi²; densities in the individual subdivisions ranged from 0.07-0.71 bears/mi². The number of independent bears is a more useful estimate than one for total bears, because of high variability in annual reproductive success documented in previous studies (Bunnell and Tait 1981, Miller 1983).

Using similar density-habitat ratings based on extensive studies at Karluk Lake, Troyer and Hensel (1969) developed a population estimate of 2,453 bears (including dependent juveniles) on Kodiak and Uganik Islands. By using the mean ratio of independent bears to total bears observed in the 2 study areas in 1987, an estimate of 2,383 bears (1,682 independent bears x 1.417) was made for Kodiak and Uganik Islands. Although the techniques used for the 2 extrapolations were different, the similarity of the 2 population estimates suggests that no major change in the brown bear population has occurred within the past 20 years.

Population Composition:

A Lincoln-Petersen estimate was used to determine composition of the brown bear population in the 2 study areas where the bear density estimation procedure had been applied in 1987 (Barnes et al. 1988). Estimated composition in the 2 study areas is shown in Table 1. Approximately 76% of the independent bears were single,

and 24% were adult females with young. Approximately 29% of the population in each study area were juvenile animals.

Aerial brown bear composition surveys, conducted annually on major tributaries of Sturgeon River, Red Lake, Frazer Lake, and Dog Salmon River by the USFWS were conducted from 23 July to 11 August 1987 (Table 2). The sample size declined in 1987, and peak counts were below average on all streams except Connecticut Creek (Victor G. Barnes, pers. commun.). Unusually low salmon escapement in Sturgeon River and Frazer Lake was probably responsible for the decline in the sample size. Single animals accounted for 78% of the independent bears observed, and maternal females composed 22% of the independent animals. These data were similar to the composition data calculated for the 2 density estimate study areas in 1987.

Distribution and Movements:

Production of both salmonberry and elderberry was unusually high in 1987. Bears appeared to have used salmon relatively lightly because of the abundant berry crops and relatively weak salmon escapement.

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 Craig 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 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 registered, master or Class A assistant guide may take bear by registration permit only.

Human-induced Mortality:

The brown bear harvest in 1987 (i.e., 151: 96 males [64%] and 55 females [36%]) was slightly below the 10-year (1978-87) mean of 154.1 bears (Table 3). The spring harvest was 101 bears: 71 males (70%) and 30 females (30%). The fall harvest was 50 bears: 25 males (50%) and 25 females (50%). Defense of life or property (DLP) and other mortalities totaled 23 animals. The total documented mortality in 1987 was 174 bears. Young bears (i.e., 2-5 years old) composed 42% of the sport and DLP harvest (Table 4). The most common age class in the harvest was 3 years.

An increasing trend in size of skulls and age of males in the harvest is indicated (Table 5). The 7.7 year mean age of males in 1987 was the highest recorded in the past 10 years. The mean skull

size for males (i.e., 24.9 in) was also the largest recorded during that period.

The female sport harvest averaged 61.2 bears annually from 1983 to 1987, representing an increase over that from 1978 to 1982 (i.e., 51.4 bears). The female harvest (i.e., 55 bears) in 1987 was below the 1978-87 mean of 56.3 females.

Hunter Effort and Success. Permits were issued to 536 hunters in 1987; 436 hunters reported going afield. Of the 283 hunters going afield in hunts Nos. 201-229 (i.e., drawing permit), 47% were successful (Table 6). Although 246 permits were issued for hunt No. 250, 153 hunters went afield; 12% were successful (Table 7).

The decline from the 579 permits issued in 1986 to 246 permits issued for hunt No. 250 in 1987 resulted from a regulatory procedure; hunting on Afognak, Raspberry, Shuyak, and part of northern Kodiak Islands was changed from a registration to a drawing-permit hunt in the fall of 1987 (Table 7). The number of permits declined from 425 to 106 in the falls of 1986 and 1987, respectively.

An increasing trend in both hunting pressure and harvest has been evident in the past 4 years for both residents and nonresidents. In drawing-permit hunts Nos. 201-226, where the number of permits has remained unchanged, the number of nonresident hunters afield averaged 10% greater from 1983 to 1987 than for the previous 5 years. For resident hunters, a 6% higher permit use rate was recorded. The mean annual harvest for 1978-82 was 137.6 bears, compared with 170.2 bears for 1983-87.

Hunter success in permit hunts Nos. 201-226 also appears to be increasing. Resident hunter success averaged 33.1% (208/629) for 1978-82 and 38.0% (265/698) for 1983-1987. Nonresident hunter success averaged 76.9% (357/464) for 1978-82 and 82.8% (414/529) for 1983-1987.

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.

Habitat issues and the increasing incidence of nonsport mortality related to expanding human activity in Unit 8 were discussed in detail in a paper presented at a symposium on bear-human conflicts in 1987 (Smith et al. 1988).

Game Board Action and Emergency Orders

Changes in the brown bear regulations in Unit 8 have been made in 4 of the past 5 regulatory years. A Board of Game subcommittee made an extensive review of the problems encountered by guides in trying to fill bookings under the drawing-permit system. The Board passed a regulation, effective in 1983-84, changing permit hunts Nos. 201-226 to registration hunts for nonresidents while retaining the drawing for residents and nonresidents guided by next-of-kin. Nonresidents guided by next-of-kin were limited to 8 permits per year. Although the Department took a neutral position on that issue, it pointed out that nonresident harvest was expected to increase because of a higher frequency of permit use.

A continued increase in the fall season harvest on Afognak Island prompted the Department to recommend changing the opening date there from 25 October to 8 November. They also recommended an opening-date change from 1 October to 25 October for the northeastern Kodiak Island registration permit hunt, where hunting pressure had also been increasing. Both changes were adopted by the Board for regulatory year 1984-85.

The Board adopted a 1-15 April subsistence brown bear season by registration permit for Alaskan residents in 1986-87. Upon reconsidering the subsistence use of brown bears, the Board rescinded that hunt when they decided to reclassify brown bears as a nonsubsistence species in Unit 8 in 1987-88.

Increased opportunistic harvests of females in the registration hunt by deer and elk hunters prompted the Department to recommend creating 3 new drawing-permit hunts for Afognak and most of northeastern Kodiak Island. The Board also considered an alternative recommended by the Kodiak Fish and Game Advisory Committee that would close the fall season and retain the registration hunt in the spring. The Board adopted the new drawing-permit hunts for 1987-88 with uniform season dates; i.e., 25 October-30 November and 1 April-15 May.

CONCLUSIONS AND RECOMMENDATIONS

The change from a registration to a drawing-permit hunt for Afognak and part of northeastern Kodiak Island was effective in reducing the fall harvest on Afognak Island. Only 4 bears were taken there in the fall of 1987, compared with 12 in 1988.

The current management objective is to maintain a population that can sustain an annual sport harvest of 150 bears with 60% males Although that objective is being met, a revised management plan (i.e., in progress) will emphasize management for large trophy bears and population diversity.

A recent increasing trend in sport harvest is evident. Mean age and skull size of the harvested bears remain high, and hunter success is increasing. These factors suggest that the bear

population is relatively high. Population estimates made in 1987 have further confirmed that brown bear abundance is at least as great as it was in the 1960's. Although an increasing trend in both sport harvest and DLP mortality should be monitored closely, the present level of human-induced mortality appears to be sustainable.

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PREPARED BY:

Roger B. Smith
Game Biologist III

SUBMITTED BY:

Lawrence J. Van Daele
Acting Survey-Inventory Coordinator

Table 1. Composition of independent brown bears (not including dependent young) in the Terror Lake and southwest Kodiak Island study areas in Unit 8. 1987.

	Terror Lake			Southwest Kodiak		
	No.	(SE)[a]	%	No.	(SE)	%
Females with coys[b]	9.3	(0.9)	11.2	10.9	(4.3)	8.6
Females with ≥ 1-yr-olds	10.9	(2.3)	13.1	20.3	(3.5)	15.9
Single bears	63.0	(16.4)	75.7	96.1	(15.5)	75.5

[a] standard error.
[b] cubs-of-the-year.

Table 2. Annual brown bear aerial stream composition counts in Unit 8, 1978-87.

Year	No. Complete surveys	Single bears		Maternal bears		Yearlings +		Cubs		Total
		No.	%	No.	%	No.	%	No.	%	
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

Table 3. Annual brown bear sport harvest, defense of life or property deaths, and other mortality in Unit 8, 1978-87.

	Sport harvest						DLP[a] deaths	Other mortality	Total mortality
	Males	% males	Females	% females	Unk. sex	Total			
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

[a] defense of life or property.

Table 4. Age class distribution of brown bears killed in sport harvests or in defense of life or property in Unit 8, 1987.

Age	No. males	Percent males	No. females	Percent females	Total	Percent of total
1	0	0	2	3.5	2	6.4
2	6	6.0	3	5.3	9	5.7
3	18	18.0	8	14.0	26	16.6
4	8	8.0	5	8.8	13	8.3
5	11	11.0	7	12.3	18	11.5
6	8	8.0	5	8.8	13	8.3
7	8	8.0	2	3.5	10	6.4
8	10	10.0	7	12.3	17	10.8
9	10	10.0	5	8.8	15	9.6
10	3	3.0	3	5.3	6	3.8
11	4	4.0	4	7.0	8	5.1
12	4	4.0	1	1.8	5	3.2
13	3	3.0	1	1.8	4	2.6
14	1	1.0	2	3.5	3	1.9
15	1	1.0	0	0	1	0.6
16	1	1.0	0	0	1	0.6
17	2	2.0	0	0	2	1.3
18	1	1.0	0	0	1	0.6
19	0	0	1	1.8	1	0.6
20	0	0	0	0	0	0
21	0	0	1	1.8	1	0.6
22	1	1.0	0	0	1	0.6
Totals	100		57		157	

Table 5. Mean age and skull size of brown bear sport harvest in Unit 8, 1978-87.

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)

Table 6. Hunter residency and success for brown bear drawing-permit hunts Nos. 201-229 in Unit 8, 1978-87.

	Residents				Nonresidents				All hunters			
Year	No. permits available	No. numbers	No. successful	% success	No. permits available	No. hunters	No. successful	% success	No. permits available	No. hunters	No. successful	% 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%

[a] Hunt nos. 227, 228 and 229, which had been previously included in registration hunt 250, were added to the drawing hunts in fall 1987.

Table 7. Hunter residency and success for brown bear registration permit hunt No. 250 in Unit 8, 1978-1987.

	Residents				Nonresidents				All hunters			
Year	No. permits issued	No. hunters	No. successful	% success	No. permits issued	No. hunters	No. successful	% success	No. permits issued	No. hunters	No. successful	% 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[a]	557	321	30	9%	22	18	6	33%	579	339	36	11%
1987	226	135	10	7%	20	18	8	44%	246	153	18	12%

[a] Most of registration permit area was included in drawing hunt nos. 227, 228, and 229 in fall 1987.

STUDY AREA

GAME MANAGEMENT UNIT: 9 (45,500 mi²)

GEOGRAPHICAL DESCRIPTION: Alaska Peninsula

BACKGROUND

The Alaska Peninsula is recognized worldwide as a premiere brown bear area, and the Board of Game has placed a high priority on maintaining the quality of this population. Because of relatively easy aircraft access over much of the unit and the quality of the brown bear population, an active guiding industry developed on the Alaska Peninsula during the 1960's. As hunting pressure increased, several studies were initiated to acquire more information on brown bear ecology. During the late 1960's and early 1970's, the Alaska Department of Fish and Game (ADF&G) investigated the reproductive biology and survival rates of brown bears at McNeil River State Game Sanctuary. A succession of graduate students from Utah State University conducted observational studies of brown bear behavior at McNeil River during the early 1970's.

Another intensive study was conducted during the early 1970's near Black Lake in the central portion of Subunit 9E. To acquire information on reproductive parameters, movements, and harvest rates, several hundred brown bears were captured and marked. Some effort has been directed at further analysis of data from this study to better understand the population dynamics of an exploited brown bear population. Results of this work will be reported in conjunction with the upcoming Black Lake study.

Following high harvests in 1972-73 and coincidental poor salmon escapements in most Alaska Peninsula systems, there were indications that reductions in the hunting season were needed. These reductions took the form of Emergency Closures 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 current 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 brown bear population to recover during the late 1970's. Since then, both the bear population and harvest have increased.

POPULATION OBJECTIVES

To maintain a high brown bear population having a sex and age structure that will sustain a harvest composed of 60% males, including at least 50 adult males 8 or more years old.

METHODS

Historically, managers have relied heavily on interpretation of harvest statistics (i.e., total harvest, sex ratios, age composition) to monitor brown bear populations. In recent years some attention has been given to using various computer models (Tait 1983, Harris 1984) to aid in evaluating the usefulness of harvest data. Although work is continuing, it is already apparent that (1) inherent problems with the use of harvest data exist and (2) supplementary means of detecting changes in heavily exploited brown bear populations are needed.

Aerial surveys of brown bears concentrated along salmon streams have been used in Unit 9 periodically since 1958 primarily to detect major changes in population composition. Erickson and Siniff (1963) identified the limitations of these surveys and recommended procedures to standardize the technique. Surveys have subsequently been conducted by various agencies in several areas on the Alaska Peninsula; i.e., ADF&G near Black Lake, U. S. Fish and Wildlife Service (FWS) in the Becharof, Ugashik, and Izembek areas, and the National Park Service (NPS) in Katmai National Park.

The FWS has conducted additional brown bear research at Becharof and Izembek National Wildlife Refuges (NWR). Results of these studies are pending a final year of radio tracking. The ADF&G has recently entered into cooperative agreements with the FWS and NPS to conduct a comprehensive brown bear study near Black Lake beginning in June 1988.

RESULTS AND DISCUSSION

Population Status and Trend

The brown bear population in Unit 9 was probably somewhat depressed during the mid 1970's because of a combination of high harvests, weak salmon escapements, and severe winters. With reduced harvests during the late 1970's, bear densities increased until at least 1984. The population density remains high, but the rate of growth appears to have slowed or stopped in some areas. Poor weather in the Black Lake area precluded aerial surveys during the peak bear concentration in 1987. Counts at Becharof Lake (by FWS personnel) and McNeil River remained at near-record levels.

Population Size:

Brown bear densities vary within Unit 9; generally, they are lower in northwestern Subunit 9B and higher in the salmon rich drainages in Subunits 9C and 9E. Data from the Black Lake study (ADF&G files) in the early 1970's were used to reconstruct the minimum population between 1972 and 1973; our reconstruction suggests a density of about 1 bear/5-6 mi^2, which is in agreement with their estimate of 1 bear/6 mi^2 (Miller and Ballard 1982). This estimate

will be compared with one generated from a census (Miller et al. in press) to be completed in the Black Lake area in 1989. 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. Following the 1989 census at Black Lake, the rest of Unit 9 will be stratified and a total population estimate made.

Population Composition:

One hundred seventy-five bears, including 30 (17%) females with young, 36 (20%) cubs and 33 (19%) yearling and older offspring, and 76 (43%) single bears, were observed during 1 completed survey and 1 partially completed survey of the Black Lake study area. Poor weather forced the first survey (7 August) to be aborted, and by the time weather had improved (i.e., 12 August) it was too late to observe the peak of bear use of the study area. Although total sample size was impacted by the poor conditions, I believe the composition of bears observed was representative of past years (Table 1). The low proportion of "yearlings" observed in 1987 reflects the poor cub production noted in 1986.

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 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 a line 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 years 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 in 1987.

The open season for the remainder of Subunits 9C and 9D, and Subunit 9A, 9B, and 9E for subsistence, resident, and nonresident hunters is 1 to 21 October. The bag limit is 1 bear every 4 regulatory years.

Human-induced Mortality:

The reported harvest in Unit 9 for 1987 was 262 bears, including 132 males, 118 females, and 12 whose sex was not determined (Table 2). This harvest was slightly below the record harvest of 278 in 1972. In 1987 the season was 21 days long, while in 1972 both spring and fall seasons totaled 47 days. Fall harvests have increased steadily since 1974. The 1987 harvest represents the lowest proportion of males (52%) in a fall harvest since 1975. The high harvest and low percentage of males taken during 1987 were

due, in part, to the addition of the 1st week of October to the season. From 1 to 6 October, 120 bears were taken with a 50:50 sex ratio. During the remainder of the season, 55% of the harvest were males. I suspect that while many bears were still feeding on salmon streams during early October, males were relatively less vulnerable because their activity was more nocturnal than that of females.

During the fall of 1987 a total of 16 males (6.6%) ≥8 years old were harvested, the lowest proportion since 1977. The actual number of trophy size males (≥28 inches total skull size) taken in 1987 was not significantly different than those for the previous 3 fall seasons.

Hunter Residency. In 1987, 63% of the harvest in Unit 9 was by nonresidents; this is below the 72% average for the previous 5 fall seasons. Because nonresidents are required to have a guide and are usually more selective toward shooting a male bear, the low proportion of males in the 1987 harvest may also reflect the increased number of resident hunters in the field.

Permit Hunts. The registration permit hunt in the Naknek River drainage was designed to minimize bear-human conflicts in the most heavily settled portion of Unit 9. Two of the 3 bears taken in the fall hunt were potential nuisance bears. At least 2 other bears were known to have been killed within 3 miles of the village of Naknek under defense-of-life-or-property (DLP) circumstances. Neither of these kills were properly reported. This registration hunt has been conducted for the past 12 years, and it has been partially successful in reducing the threat of problem bears. The hunt has remained moderately popular. Forty-one permits (14 spring, 27 fall) were issued in 1987, and most went to local residents.

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

Harvest Chronology. From 1973 to 1983, the fall season ran from 7 to 21 October. In 1985 the season was expanded to include the first 6 days of October. Because of favorable weather during this first week of October 1987, many bears were still feeding along salmon streams; consequently, hunter success was high. Nearly half (120 bears) of the 1987 harvest was taken during the first 6 days of October; the sex ratio was 50:50. In Subunit 9E more females (54%) than males were harvested during the first 6 days in 1985 and 1987. Thus even a small adjustment in the season had a significant effect on both total harvest and sex ratio of the harvest.

Game Board Actions and Emergency Orders

During the March 1988 meeting, the Board of Game considered a number of proposals to liberalize the brown bear season in Unit 9. Most of the proposals cited one or more of the following justifications: very high bear population, severe predation on moose calves, and threats to villages from nuisance bears. The board opted to retain the existing seasons because (1) harvests have increased substantially under the existing season dates, except for spring 1986 when poor weather during the first week of the May season reduced hunter success; (2) the percentage of females in the fall harvest has gone down; and (3) remedial action to correct for an overharvest, should it occur, would be very difficult to implement without going to extremely short seasons or a permit system.

CONCLUSIONS AND RECOMMENDATIONS

All indications are that the bear population in Unit 9 remains high and that the management objectives are being met. The upcoming research project at Black Lake will provide much needed data on population size, sex and age composition, impact of harvests, and the effectiveness of stream surveys in monitoring trends in population size and composition.

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PREPARED BY:

Richard A. Sellers
Game Biologist III

SUBMITTED BY:

Lawrence J. Van Daele
Acting Survey-Inventory Coordinator

Table 1. Brown bear composition from Black Lake trend counts, Subunit 9E, 1982-86.

Year	Percent females w/young	Percent cubs	Percent yrlgs	Percent 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
1987	17	20	19	43	175	147	52.0	1[a]

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

Table 2. Annual brown bear sport harvest statistics in Unit 9, 1982-87.

Year	Males	Females	Total	Percent by nonresidents	Mean age	
					Males	Females
1982	134	75	211	76	6.5	7.5
1983	119	78	199	70	5.6	8.0
1984	160	64	228	64	7.3	7.5
1985	125	95	228	73	6.2	8.6
1986	128	61	190	67	8.4	7.0
1987	132	118	262	63	5.9	7.5

STUDY AREA

GAME MANAGEMENT UNIT: 10

GEOGRAPHICAL DESCRIPTION: Unimak Island

BACKGROUND

Unimak Island is the only island in Unit 10 occupied by brown bears. The island is within the Alaska Maritime National Wildlife Refuge (NWR) and is almost exclusively classified as wilderness. Brown bear hunting on Unimak Island has been conducted under drawing permits administered by the U. S. Fish and Wildlife Service (FWS) from 1949 to 1979 and thereafter by the state; 15 permits are issued per year (i.e., 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. To accomplish this, hunter numbers will continue to be limited and harvests will be maintained below maximum sustained yield.

POPULATION OBJECTIVE

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

METHODS

The FWS has periodically conducted aerial bear surveys on Unimak Island during late summer; however, none have been conducted since 1983. Because of very low harvests, meaningful interpretation of harvest data is impossible.

RESULTS AND DISCUSSION

Population Status and Trend

With favorable environmental conditions and harvest rates consistently below sustained-yield levels, the Unimak brown bear population is maintained by natural regulatory mechanisms at a relatively stable level. Although population size and density have not been evaluated specifically on Unimak Island, the results of past surveys and extrapolation of density estimates made elsewhere in Alaska have yielded a rough estimate of approximately 200 brown bears residing on the island. A density estimate will be derived for the central portion of the Alaska Peninsula, and this may help to refine the estimate for Unimak Island, especially if summer aerial surveys of Unimak are resumed.

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 bear every 4 regulatory years by drawing permit only; 15 permits are issued annually.

Human-induced Mortality:

Of 7 permits issued for spring 1987, 5 hunters participated and 3 brown bears were harvested (i.e., 2 males and 1 female). For the fall of 1987, 8 permits were issued; 6 permittees reported hunting, and 1 female and 4 male brown bears were taken. This harvest is slightly higher than those for the previous 4 years (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 to a limited (first-come, first-served) registration system for the fall 1985 and spring 1986 seasons. Because of lack of data to substantiate any traditional subsistence use of bears on Unimak Island, several complaints from the public about the registration permit, and administrative problems for the Izembek NWR, the board reverted back to a drawing-permit hunt for the 1986-87 seasons. I recommend retaining the existing system and number of permits issued.

CONCLUSIONS AND RECOMMENDATIONS

The brown bear population on Unimak Island appears healthy and stable, and the drawing-permit hunt has been meeting the management objectives. In the past 5 years, 25% of the bears harvested have been ≥10 years old and hunters have reported seeing an average of 8.3 bears while on Unimak Island.

The brown bear population estimate for Unimak Island should be refined by applying knowledge from a study of bears on the Izembek NWR and a research project soon to be initiated near Black Lake. I recommend that late-summer aerial surveys be resumed and the results used to stratify the island for bear densities. Pending results from the Black Lake study and further evaluation of Unimak Island and Izembek NWR aerial surveys, the population may be adequately monitored by use of relatively low-cost surveys.

PREPARED BY:

Richard A. Sellers
Game Biologist III

SUBMITTED BY:

Lawrence J. Van Daele
Acting Survey-Inventory Coordinator

Table 1. Brown bear harvest data for Unimak Island (Unit 10) permit hunt No. 235, 1983-87.

Year	Permits issued		Did not hunt		Unsuccessful hunters		Males		Females		Total harvest
	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

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

STUDY AREA

GAME MANAGEMENT UNIT: 11 (14,000 mi²)

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 they were considered abundant.

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

POPULATION OBJECTIVE

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

METHODS

Monitoring of harvests will be continued by maintaining the mandatory sealing requirement for all harvested brown bears. The sex and age composition of the harvest will be assessed by determining sex, measuring skull size, and extracting a tooth at time of sealing. Harvest data will continue to be analyzed to determine if objectives are being met.

RESULTS AND DISCUSSION

Population Status and Trend

Population data are currently unavailable for brown bears in Unit 11, because no 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 and yearlings 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:

Seven brown bears were reported killed during 1987 in Unit 11 (Table 1). Males composed 67% (n = 4) of the harvest. The mean age of harvested males was 7.9 years, well above the 19-year mean of 7.2 years. The mean skull size for males was 20.5 inches, down slightly from the 26-year mean of 21.7 inches.

Hunter Residency and Success. Nonresident hunters took 2 (29%) brown bears during 1987, a decline from the previous year's nonresident take of six (67%). The annual harvest by nonresidents has declined from an average of 11 (range = 2-18) bears per year between 1961-78 to only two (range = 0-6) since 1978.

Harvest Chronology. There were 3 (43%) brown bears harvested during the spring season and four (57%) reported in the fall. From 1961 to 1986 hunters reported taking 290 (83%) bears in the fall, compared with only 52 (17%) 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

Adopted in 1976, the brown bear management guidelines for Unit 11 called for sustained-yield harvests as well as the greatest opportunity to participate in hunting brown bears. The Board of Game has not altered these guidelines; however, season dates were liberalized in 1981 and 1982 to provide more hunting opportunity in response to declining bear harvests. The bag limit has not been changed.

CONCLUSIONS AND RECOMMENDATIONS

Brown bear harvests averaged 16 bears per year from 1961 to 1978. Since 1979 harvests have averaged only 7 bears per year. The decline in both the total and nonresident harvests has resulted from the establishment of Wrangell-St. Elias National Park/Preserve. National Park Service regulations prohibit sport hunting in portions of the unit designated as park. Subsistence hunting by local rural residents has continued in these areas; however, hunters cannot use aircraft for access. This effectively closes most of the park to all hunting. Sport hunting and aircraft access are allowed in areas designated as preserve.

Since 1961, 60% of the bears harvested were males; however, the percentage of males in the harvest has increased; since 1979 it has composed 64% of the take. Mean age and skull sizes fluctuate yearly because of the small sample size. Generally speaking, harvested bears taken in Unit 11 have been older and larger than those in Unit 13, where harvest rates are higher. Sex and age composition data suggest that the bear population in Unit 11 is stable or increasing.

Bear harvests are currently very low and have little, if any, impact on the unit-wide bear population. Some additional hunting opportunity could be provided without impacting overall bear numbers; however, no change in season dates or bag limit are recommended at this time.

PREPARED BY:

Robert W. Tobey
Game Biologist III

SUBMITTED BY:

Lawrence J. Van Daele
Acting Survey-Inventory Coordinator

Table 1. Brown bear harvests in Unit 11, 1973-1987.

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
Totals 1973-1987	183	107	62%	66	38%	10	100	55%	
Totals 1961-1987	349	198	60%	133	40%	18	211	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 north Wrangell Mountains

BACKGROUND

In accordance with the 1976 Strategic Yukon-Tanana Brown Bear Management Plan, the management goal for grizzly bears in Unit 12 is to provide maximum opportunity to participate in hunting them. Regulations were more restrictive prior to the 1980's than they are presently; however, hunter participation has never been restricted by limiting the number of permits.

Grizzly bear and moose management in Unit 12 are integrated, because grizzly bears are known predators of both calf and adult moose. In the Little Tok River drainage, mortality of moose calves ≤ 5 months is high; early predation by bears is the probable cause. Similar moose mortality patterns were documented in adjacent Subunit 20E (Boertje et al. 1987). Present management strategies call for the reduction of bear populations until moose populations recover. At the same time, reproductive rates of Interior grizzly bear populations are relatively low, and care must be taken not to threaten their long-term viability.

MANAGEMENT OBJECTIVES

To effect temporary reductions in the grizzly bear population or the extent of predation where it is limiting moose population growth by contributing to fall calf:cow ratios of less than 30 calves:100 cows.

To sustain harvests of at least 25 grizzly bears from Unit 12.

To reduce grizzly bear harvests so that the decline in the population can be reversed after moose populations have increased to desired levels.

METHODS

Harvest data were gathered from mandatory sealing of grizzly bear hides and skulls by ADF&G staff or an appointed sealer. Ages of harvested bears were determined from cementum layers of extracted premolar teeth.

RESULTS AND DISCUSSION

Population Status and Trend

Grizzly bears have never been surveyed in Unit 12, because the area is largely forested and no seasonal concentrations in open areas occur. Harvests, incidental field observations, and hunter reports indicate that grizzly bear numbers are stable. A decrease in numbers is desired to increase depressed moose populations.

Population Size:

If we assume that grizzly bears have been and are currently being harvested at close to the sustained-yield level (5-8%), then Unit 12 contains approximately 275-440 bears. Sex ratio data (Table 1) suggest this may be a conservative estimate.

Population Composition:

No accurate estimate of population composition can be made from harvest statistics because not all sex and age classes of grizzly bears have the same susceptibility to hunters. Based upon ages of harvested grizzly bears, old-aged (≥15 years) ones still inhabit the unit and younger adults and subadults are well represented in the population. Incidental observations indicate the presence of females with family groups.

Distribution and Movements:

Based upon incidental observations and reports of harvest locations, grizzly bears frequent all portions of Unit 12, except the vast ice fields in the northern Wrangell Mountains. Grizzly 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.

In early spring grizzly bears commonly move down to the glacial river bottoms to dig roots of peavine and to scavenge carcasses of moose and caribou that had died during winter months. Females accompanied by cubs of the year generally avoid other adult bears at this time 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. Bears remain there until denning in October or early November. In 1987 atypical shortages of staple berry crops caused some bears to return to valley bottoms, where they fed upon lowbush cranberries, and 3 males were attracted to human garbage near Tok and were shot.

Mortality

Season and Bag Limit:

In that portion of Unit 12 north of the crest of the Mentasta Mountains and west of the Nabesna River, the open season is from 1 September to 30 June. In the remainder of Unit 12 the open season is from 1 September to 10 June. The bag limit is 1 bear.

Although the bears harvested in Unit 12 do not count against the 1 bear every 4 years bag limit in other units, no one may take more than 1 bear in Alaska during each regulatory year. Cubs and females accompanied by cubs are protected by regulation.

Human-induced Mortality:

Sealing certificates indicate that 20 grizzly bears were harvested in Unit 12 during 1987, compared with the 5-year (1983-87) mean of 22 bears (Table 2). Since regulations were liberalized in 1981, the mean harvest has been 23 bears, representing a 26% increase over that for 1974-80 (18 bears).

Of the 20 bears harvested, 15 (75%) were males, four (20%) were females, and one was not specified (Tables 1 and 2). No trend is evident in the sex composition of the harvest for the past 5 years; males and females composed a mean of 59% and 41% of the harvest, respectively. Five (38%) of 13 known-age males were ≥5 years. Two (50%) of 4 known-age females were also older than 5 years. No clear trend in the proportion of adult males in the harvest has been evident over the past 5 years.

The White River drainage contributed heavily to the 1987 grizzly bear harvest in Unit 12 with 35% (n = 7) of the harvest; 25% (n = 5) of the harvest occurred in the Nutzotin and north Wrangell Mountains (i.e., not the White River drainage); 25% (n = 5) in the Mentasta Mountains; 10% (n = 2) in the Tanana River drainage; and 5% (n = 1) in the Tok River drainage. One grizzly bear was also wounded in defense of life or property (DLP) in Tok.

Hunter Residency and Success. Resident Alaska hunters took 14 (70%) bears, while nonresidents took only six (30%) (Tables 1 and 2). These proportions have been relatively constant since 1982, when the 1 bear per regulatory year bag limit was instituted. From 1974 to 1980, the proportionate harvest by residents and nonresidents was reversed; residents harvested only 37% of the harvest. This change probably resulted from liberalizing the bag limit to 1 bear per year. Few nonresidents take a bear each year. Nearly all of the 26% increase in overall mean harvests since 1981 is attributable to the 110% increase in mean harvests by resident bear hunters. Therefore, as intended, the more liberal bear hunting regulations in Unit 12 have increased the harvests and resident hunters have benefited the most.

Harvest Chronology. Four (20%) grizzly bears, all males, were taken during the spring, and 16 (80%) were taken in the fall. Two each were taken in May and June, 1 male was taken in July (DLP), 13 in September, and 2 in October. The first grizzly bear of the year was taken on 11 May, and the last one was taken on 25 October.

Natural Mortality:

Few instances of natural grizzly bear mortality have been noted in Unit 12. Based upon observations in nearby areas, male bears have been suspected of killing grizzly cubs. One instance was reported of an adult male killing a subadult (i.e., 4 years) male near Chisana; another incident was reported where 2 adult males killed each other near Tetlin.

Habitat Assessment

Nearly all of Unit 12 is suitable grizzly bear habitat. Unlike other areas in Southcentral and Southeast Alaska, however, Interior grizzly bears do not have the benefit of strong, concentrated salmon runs. Vegetation, predation, and scavenging provide their sustenance.

Game Board Actions and Emergency Orders

Prior to 1978, grizzly bear hunting regulations were conservative (i.e., 47 days), providing 10 September to 10 October and 10 to 25 May seasons and a 1 bear per 4 regulatory years bag limit. 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 the growth rates of low density moose populations in Unit 12. In 1978 the Board extended the fall bear season by 9 days, opening it on 1 September. In 1979 the bear season was extended further (i.e., 1 September-30 November and 1 April-31 May seasons), providing 92 effective days of hunting. In 1981 the season was again extended from 1 September to 10 June (i.e., 102 days); it continued through the spring of 1987. Beginning in 1982 the bag limit was liberalized to 1 bear per regulatory year. The resident bear tag requirement was waived during 1984 and 1985, but it was reinstated beginning in 1986. Finally, for the 1987-88 regulatory year the close of the season in northwestern Unit 12 was extended to 30 June (i.e., 122 days); the bag limit of 1 bear per regulatory year and a $25 resident tag were required. To prevent false recording of the location of bear kills, an in-unit sealing requirement was instituted for 1987.

CONCLUSIONS AND RECOMMENDATIONS

Liberalizations in grizzly bear hunting regulations, particularly the season extensions and bag limit increase since 1981 and 1982, are having the desired effects of increasing bear hunting opportunity and harvests. A doubling in the annual harvests by resident hunters has resulted in an overall harvest 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.

Harvest statistics do not show any obvious trends to indicate harvest is lowering the grizzly bear population. However, changes in harvest statistics may not allow detection of short-term population changes. This is particularly true when sample sizes of sealed bears are relatively small. I think data on hunter success rate will indirectly reflect bear population trends.

I recommend that current, liberal bear hunting regulations be retained to maximize bear harvests over the next 5 years. I further recommend that a brown/grizzly bear harvest ticket be developed and used to assess trends in hunter success rates statewide.

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PREPARED BY:

David G. Kelleyhouse
Game Biologist III

SUBMITTED BY:

Wayne E. Heimer
Survey-Inventory Coordinator

REVIEWED BY:

Harry V. Reynolds, III
Game Biologist III

Table 1. Characteristics of grizzly bear harvests taken in Unit 12, 1983-87.

Year	No. taken	Percent taken		Percent males		Percent females		Percent	
		Res.	Nonres.	Total	≥5 years	Total	≥5 years	Spring	Fall
1983	15	73	27	67	30	33	40	7	93
1984	40	60	40	62	33	38	60	40	60
1985	21	62	38	45	63	55	64	19	81
1986	22	64	36	45	40	55	25	18	82
1987	20	70	30	75	38	25	50	20	80
$\bar{x}$	24	66	34	59	41	41	48	21	79

Table 2. Harvests of grizzly bears in Unit 12, 1983-87.

Year	No. harvested			No. males		No. females		No. spring	No. fall
	Total	Res.	Nonres.	Total	≥5 years	Total	≥5 years		
1983	15	11	4	10	3	5	2	1	14
1984	40	24	16	24	8	15	9	16	24
1985	21	13	8	9	5	11	7	4	17
1986	22	14	8	10	4	12	3	4	18
1987	20	14	6	15	5	4	2	4	16
$\bar{x}$	24	15	8	14	5	9	5	6	18

STUDY AREA

GAME MANAGEMENT UNIT: 13 (23,000 mi²)

GEOGRAPHICAL DESCRIPTION: Nelchina Basin

BACKGROUND

Brown bears were numerous in Unit 13 from the early 1900's until the federal government initiated predator control in 1948. The brown bear population was reduced throughout the unit as an incidental result of federal wolf-poisoning programs that were conducted from 1948 to 1953. Following cessation of these activities, brown bear numbers increased; by 1979 they were once again considered abundant throughout Unit 13 (Spraker et al. 1981).

The brown bear harvest in Unit 13 has increased substantially over the years. The average annual harvest from 1961 to 1969 was 39 bears, from 1970 to 1979 it was 58 bears, and since 1980 it has averaged 110 bears annually. Demand for brown bear hunting by recreational hunters has increased substantially over the past 5 years. Spring seasons have been especially popular.

POPULATION OBJECTIVES

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

METHODS

The harvests will continue to be monitored by requiring mandatory sealing of all brown bears taken. Harvest data are obtained by determining sex, measuring skull size, and extracting a tooth at time of sealing. Harvest data will continue to be analyzed to determine if objectives are being met or maintained. In addition, a periodic bear census (i.e., 5-year intervals) may be conducted to update previous population estimates or to obtain density estimates for additional areas in the unit.

RESULTS AND DISCUSSION

Population Status and Trend

Brown bears were considered numerous in Unit 13 by the mid- to late 1970's, when the population was probably expanding. During this period, the population in Unit 13 had relatively high bear densities for the Interior (Ballard et al. 1980). The growth of the brown bear population in Unit 13 was halted after 1980, when harvest rates began increasing. Since then bear numbers have been

declining in the more accessible, heavily hunted portions of the unit. As a result, the overall population is lower than it had been before liberalization of harvests had begun.

Population Size:

The 1st brown bear density estimate for a portion of Unit 13 was obtained during a 1979 bear transplant along the Upper Susitna River in Subunits 13B and 13E. The resulting estimate for this area was 1 bear/16 mi^2 and 1 bear ≥2.0 years old/30 mi^2 (Miller and Ballard 1982, Miller 1988). A 2nd density estimate of 1 bear/13.8 mi^2 was obtained in 1985 along an adjacent area near the Susitna River (Miller et al. 1987). This area was also in Subunits 13B and 13E. Extrapolation of the 1979 and 1985 density estimates to the remainder of Unit 13 resulted in a unitwide population estimate of from 1,400 to 1,600 brown bears for the intervening period.

A new density estimate was obtained for a 505-mi^2 portion of the upper Susitna River study area (1,326 mi^2) during 1987, in an attempt to monitor changes in bear numbers over time. Miller (1988) estimated a density of 1 bear/37 mi^2 and 1 bear ≥2.0 years old/58 mi^2. This estimate suggests current bear densities in the upper Susitna are roughly half of those previously observed in this area.

The density estimates obtained in 1985 and 1987 were applied to the rest of Unit 13, using a subjective stratification of the unit (Miller, pers. commun.). This resulted in a maximum brown bear population estimate of 1,100-1,200 animals for Unit 13.

Population Composition:

During the Susitna Hydroelectric Project studies, Miller (1987) observed that brown bear litter sizes averaged 2.1 as year and 1.7 as 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 an Interior population.

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, while female offspring utilize the maternal home range. 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 those bears radio-collared for various research projects in Unit 13: Spraker et al. (1981), Ballard et al. (1982), and Miller and Ballard (1982).

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 sport harvest in 1987 was 104 brown bears. In addition, 3 brown bears were reported killed in defense of life or property (DLP). The sport harvest was composed of 51 (55%) males, 42 (45%) females, and 11 bears whose sex had not been determined (Table 1). The mean age for all harvested males and females in 1987 were 5.9 years and 6.9 years, respectively. These values approach the 19-year averages of 6.0 and 7.0 years for males and females, respectively. The mean skull sizes were 21.1 and 19.6 inches for males and females, respectively. The mean age and skull sizes for both sexes in the yearly harvests have indicated little change. However, the mean age of males in the fall has been generally lower, averaging 4.9 years over the past 8 years (1980-87). Inter-pretation of age and size data is difficult; younger animals in the harvest could mean a higher reproductive and juvenile survival rate or, conversely, a higher harvest rate and little recruitment into the older age classes.

Hunter Residency and Success. Nonresident hunters harvested 34 (33%) bears in 1987, similar to the 10-year average of 31 bears per year. Trends in overall hunter success and effort cannot be determined, because we do not collect data that indicate the number of unsuccessful bear hunters in Unit 13 and the time they spent hunting.

Harvest Chronology. There were 58 (56%) and 46 (44%) brown bears harvested during the fall and the spring seasons, respectively (Table 2). Males composed 79% (n = 33) of the spring harvest but only 35% (n = 18) of the fall harvest.

Natural Mortality:

Miller (1987) reported average natural mortality rates of 38% for cubs-of-the-year and 22% for yearlings. He also identified 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 indicate a relationship between observed increases in brown bear harvests and changes in cub survivorship in Unit 13.

Habitat Assessment

Current density estimates for Unit 13 suggest that habitat conditions generally can support a good number of brown bears; however, recent observations indicate bear avoidance of the intensive mining operation at Valdez Creek (Miller 1988). I believe this demonstrates that development activity in remote areas will reduce or eliminate the usefulness of an area to support brown bears. Also, the killing of brown bears for DLP increases around remote developments and homesites, since people are generally afraid of bears in close proximity. More DLP bears are reported killed at remote sites (33%) than are reported for any other activity (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 eventually substantially reduce the carrying capacity of Unit 13 for brown bears.

Game Board Actions and Emergency Orders

Prior to 1980 the criteria adopted by the Board of Game for brown bear management in Unit 13 called for sustained-yield harvests and seasons that would provide for the greatest opportunity to participate in hunting brown bears. Seasons were generally short and there was no spring season. In 1980 the Board of Game altered the guidelines for Unit 13, after research data suggested that reduced brown bear numbers could increase moose calf survival (Ballard and Larson 1987). In 1980 and 1982 the Board of Game liberalized seasons and bag limits, respectively, in order to increase harvests, reduce the bear population, and provide for more recreational use.

Effective in the fall of 1987, the Board of Game reduced the bag limit in Unit 13 to 1 bear every 4 years, in an attempt to eliminate the practice of sealing bears in Unit 13 that had been killed in other units. By sealing a bear in a unit having a bag limit of 1 bear/year, even though it had been harvested in a unit with a bag limit of 1 bear/4 years, a hunter could have circumvented the regulation requiring successful hunters to wait 4 years before harvesting another bear. Such bootlegging of bears into Unit 13 (i.e., 1 bear/year bag limit) reduced the utility of the harvest data for determining population trends.

CONCLUSIONS AND RECOMMENDATIONS

The most recent population estimate for Unit 13 suggests we are currently approaching the stated population goal of 1,200 brown bears. This population estimate is based on the best density data currently available; however, unitwide extrapolations of density estimates obtained in 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 River study area

has caused increased sport harvests, additional factors must be considered; e.g., no bears were observed in the vicinity of the mine.

Increased gold mining development in the upper Susitna River study area since 1979 may have resulted in displacement or increased unreported killing of brown bears from that area. This supposition is additionally supported by increased observation of moose calf twins in the vicinity of the mine during fall composition counts. Also, overall densities could be lower in this area because of the residual effect of the 1979 bear transplant, in which only 60% of the transplanted bears had returned (Miller and Ballard 1982). Finally, differences in habitat conditions occur throughout the unit, resulting in density variations; e.g., field observations suggested that Subunit 13D may have higher bear densities than the study areas.

Brown bear harvests averaging 111 bears per year between 1980 and 1987 have most likely resulted in a reduction in the unitwide population estimate (i.e., approximately 1,500 to less than 1,200 bears). Research results suggest that harvests must be reduced if the bear population is to be stabilized at its current level. A sustainable harvest rate for brown bears in Unit 13, given their reproductive potential, is between 6% and 8% per year. Given current population estimates, this means a sustainable harvest should be between 65 and 95 bears a year. Miller (1988) felt the sustainable harvest in Unit 13 could include no more than 30 females. If an average harvest rate of 56% males is maintained, the potential maximum harvest is 68 bears, based on reproductive potential. The 1988 season will be the 1st full season under the new bag limit regulation (i.e., 1 bear/4 regulatory years). The fall 1987 harvest declined 40%, suggesting that this regulation may also be effective in reducing spring harvests.

Bears harvested in Unit 13 are classified by Boone and Crockett as coastal bears, yet Unit 13 bears never reach the size of bears from Kodiak Island or the Alaskan Peninsula. Therefore, trophy brown bear hunters will no longer come to Unit 13 to take a smaller bear, if they then have to wait 4 more years to hunt larger coastal bears. If harvests are not found to be within the range of estimated sustainable harvest levels after the new bag limit regulations have been in effect for 1 year, further reductions in season length will be necessary.

The population objective for Unit 13 also calls for maintaining a harvest composed of a minimum of 50% males. The current average harvest of 56% males means that the overall goal has been met. However, sex composition of fall harvests indicates that the number of females taken in the fall has exceeded the number of males since 1984. Males are more vulnerable to hunting than females, because they leave their dens earlier in the spring, travel more extensively, and are not protected once they mature, as are sows with cubs. The percentage of males in the spring harvest has been high, because hunters have been selecting for males by hunting

early in the season. Early spring hunting has been popular because snow cover allows access to remote areas by snowmachine or ski plane; however, later in the spring, access becomes difficult because of breakup. Fall hunters have not specifically selected for males; rather, they have opportunistically taken what has been available. The observed decline in the percentage of males taken in the fall suggests that either males have been less available in the population or hunting pressure has been increasing on females. The percentage of males harvested in the fall should be closely monitored as harvests are reduced.

The lack of data on unsuccessful hunting effort and success rates reduces our ability to evaluate population trends. Changes in success rates or effort can serve as indications of 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 and nonresident bear tags are sold; its return should be required by all unsuccessful bear hunters.

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PREPARED BY:

Robert W. Tobey
Game Biologist III

SUBMITTED BY:

Lawrence J. Van Daele
Acting Survey-Inventory Coordinator

Table 1. Brown bear harvests in Unit 13, 1978-1987.

Year	Total harvest	Males	(%)	Females	(%)	Unknown	Nonresident hunters	(%)	Season length (days)
1978	64	37	(60)	25	(40)	2	28	(44)	40
1979	73	39	(53)	34	(47)	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

Table 2. Brown bear harvest by season in Unit 13, 1979-1987.

Year	Unit[a] 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

[a] Sex unknown included in total.

STUDY AREA

GAME MANAGEMENT UNIT: 14A and 14B (4,780 mi²)

GEOGRAPHICAL DESCRIPTION: Upper Cook Inlet

BACKGROUND

Little information is available on the status of the brown bear population in Subunits 14A and 14B. Density surveys have never been conducted. The population has been managed primarily by indirect means, using harvest data and incidental observations of bears reported by Department staff and the public. Annual reported harvests have remained low and relatively stable; i.e., 10 or fewer since 1982. There are insufficient data to positively determine the impact of harvest on the bear population, but the low 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 Subunit 14B.

POPULATION OBJECTIVES

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

No research studies or surveys to determine brown bear density or other population parameters have been conducted in Subunits 14A or 14B. Information about population status is derived primarily by indirect means, drawing on information from brown bear studies conducted in other places in Alaska. Spring and fall harvest data were compiled from sealing information supplied solely by successful hunters.

RESULTS AND DISCUSSION

Population Status and Trend

Although no surveys to determine bear density have been conducted, hunters, guides, air taxi operators, interested members of the public, and incidental observations by Department staff indicate that brown bears are relatively scarce in Subunit 14A and more abundant in Subunit 14B. Sightings have been too infrequent and observations have been too general to detect any trends in bear numbers, but we believe brown bear numbers have remained relatively low and stable during the past 5-10 years. Because Subunit 14B is more remote and access is more limited, it probably has a higher density of brown bears than Subunit 14A.

Population Size:

Miller et al. (1987) found the density along the Susitna River in Unit 13 was approximately 1 brown bear/13-16 mi² and their habitat was almost always found an elevation of 5,000 feet. Since most (i.e., 85%) of the area in Subunits 14A and 14B is also below 5,000 feet (Sterling Miller, pers. commun.) there are approximately 2,268 mi² and 1,746 mi² of brown bear habitat, respectively. If it is assumed that Subunit 14B has a brown bear density of 1 bear/16-20 mi² (slightly lower than Unit 13), the area would contain 87-109 bears. Because Subunit 14A is more urban, the brown bear density is lower than that in Subunit 14B (i.e., 1 bear/20-40 mi², or 57-113 brown bears). If these assumptions are correct, the combined population estimate for Subunits 14A and 14B would be 144-222 bears. Although no statistical confidence can be placed on these estimates, we believe they represent the actual number of bears in the population, providing a useful reference tool for making and evaluating the impact of management decisions.

Mortality

Season and Bag Limit:

The open season for subsistence, resident, and nonresident hunters in Subunit 14A 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 1987 brown bear hunters harvested 9 bears (1 in Subunit 14A and 8 in Subunit 14B), which was close to the 5-year mean of 8.2 bears (Table 1). The mean harvest in Subunit 14A is 2 bears, compared with 5.4 bears in Subunit 14B. Harvests in both subunits have historically been low. Since 1972 the combined annual harvest has never exceeded 10 bears.

Male bears accounted for 56% of the harvest in 1987 (Table 2). In the past 5 years the percentage of males in the harvest has ranged from 50% to 71%. The wide range in the percentage of males harvested is probably due to the small sample sizes.

Data on the geographical distribution of the harvest by drainage for the past 5 years (1983-87) indicate that brown bears were harvested in the same relative proportions in most of the drainages in Subunits 14A and 14B (Table 3). The Sheep River-Iron Creek drainage consistently produced the most bears, with a mean annual harvest of 2.8 bears. The mean harvest in each of the other drainages was 1 bear or less.

Despite substantial urban development in Unit 14, particularly in Subunit 14A, the number of bears reported to have been killed in defense of life or property (DLP) has been low. Only 1 DLP brown

bear has been reported in the past 5 years (Table 1). Because incidences of people encountering bears along salmon streams are fairly common, it is possible that a few bears have been wounded or killed and the encounters not reported.

Hunter Residency and Success. Most of the brown bear harvest in Subunits 14A and 14B was by residents. In the past 5 years, the mean annual harvest by residents was 6.8 bears, compared with 1.4 bears by nonresidents (Table 4). Of the 41 brown bears killed between 1982-1987, resident hunters took 34 (83%). In the past 5 years nonresidents accounted for only 10% of the harvest in Subunit 14A and only 19% in Subunit 14B. Eighty-six percent of the brown bears taken by nonresidents were reported from Subunit 14B.

Harvest Chronology. In 1983-1987, 90% of the brown bear harvest was taken during the fall hunting seasons (Table 5). Although the spring hunting season was closed in Subunit 14A during this reporting period, it probably had little influence on the low spring harvests. The spring hunting season remained open in Subunit 14B, yet only 4 of 31 brown bears (13%) were killed in the spring. Of 27 bears killed in Subunit 14B in the fall, 24 were taken in September when moose hunting seasons were also open. These data suggest hunters preferred hunting bears in the fall in conjunction with moose hunting; consequently some hunters killed brown bears incidentally.

Game Board Actions and Emergency Orders

The present season and bag limits in Subunits 14A and 14B 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 as in Unit 13 (i.e., 1 September to 31 May), but the Board of Game took no action, pending a comprehensive review of the brown bear regulations.

CONCLUSIONS AND RECOMMENDATIONS

The highest recorded harvest in Unit 14 since statehood (i.e., 1959) was 18 brown bears (1971), and this total included bears from Subunit 14C. From 1972 to 1982 the mean harvest in Unit 14 was 5 bears, and almost all of these came from Subunits 14A and 14B. The 5-year-mean annual harvest in these subunits is 8.2 bears (range = 7-10, Table 1). The historical record indicates that brown bear harvests in Subunits 14A and 14B have been low and apparently within the sustained yield. However, because the mean annual harvest in the past 5 years is nearly double that of the previous 10 years, an attempt to assess the immediate and long-term impacts of harvest on the brown bear population seems warranted.

Miller (1988), using a deterministic model with known reproductive rates from a brown bear population in Unit 13, estimated exploitation rates for all ages of brown bears under a "no growth" scenario. When he assumed a low natural mortality rate, the

sustainable exploitation rate for all bears in the population was 5.6%; however, when he assumed a natural mortality rate of zero, the sustainable exploitation rate was 8.5%. Exploitation rates for females > 2 years were 5.8% and 9.0%, when the assumed natural mortality rates were low and zero, respectively. Although the exploitation rates reported by Miller are estimates, their data indicate that maximum annual harvest rates of brown bears in Unit 13 having low or zero natural mortality should not exceed 5.6-8.5% of the population.

The estimated brown bear population in Subunits 14A and 14B is 144-222 bears. Assuming that an exploitation rate between 5.6% and 8.5% is the maximum that the bear population in these subunits could sustain, then 8-19 bears could be harvested annually. This estimate also assumes that all bears are harvested uniformly throughout the area; this has not been the case.

Although the previous population information has been built on several assumptions, I believe this exercise is valuable for a number of reasons. Subunits 14A and 14B encompass a relatively large, remote geographical area, and a harvest of 8-10 bears annually would not appear to have a significant biological impact. However, after making estimates of the population in Subunits 14A and 14B and then comparing these estimates to a range of exploitation rates that may be sustainable, it is apparent that the current annual harvests may be closer to sustained yield than previously thought. It does not appear that sustained yield has been exceeded, but if annual harvests increase another 5-15 bears, that potential exists, especially if the harvest is concentrated in a few drainages.

I do not recommend making any changes in season length or bag limits at this time for the following reasons: (1) present harvests appear to be near or below sustained yield in most areas and annual harvests have been relatively consistent during the past 5 years; (2) the percentage of male bears in the harvest has never been lower than 50% (mean = 56%), even though most of the harvest occurred in the fall when females are more vulnerable; (3) a harvest of 56% males is close to the population objective of 60% males, and the population goal of 160 bears falls within the population estimate of 144-222 bears; and (4) because significant portions of Subunits 14A and 14B are urban, with relatively high numbers of people living in "rural subdivisions", maintaining relatively low numbers of brown bears minimizes conflicts between people and livestock.

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PREPARED BY:

Carl A. Grauvogel
Game Biologist III

and

Judy Sherburne
Game Technician IV

SUBMITTED BY:

Lawrence J. Van Daele
Survey-Inventory Coordinator

Table 1. Historical summary of brown bear harvest in Subunits 14A and 14B, 1983-1987.

Year	Harvest: Spring 14A No.	Spring 14A (%)	Spring 14B No.	Spring 14B (%)	Fall 14A No.	Fall 14A (%)	Fall 14B No.	Fall 14B (%)	Total 14A & 14B combined No.	Non sport DLP[a]
1983	0	(0)	0	(0)	2	(29)	5	(71)	7	0
1984	0	(0)	1	(10)	5	(50)	4	(40)	10	1
1985	0	(0)	3	(43)	1	(14)	3	(43)	7	0
1986	0	(0)	0	(0)	1	(13)	7	(88)	8	0
1987	0	(0)	0	(0)	1	(11)	8	(89)	9	0
Total	0	(0)	4	(10)	10	(24)	27	(66)	41	1
Mean	0.0		0.8		2.0		5.4		8.2	.2

[a] Defense of Life or Property (DLP) is not included in harvest total.

Table 2. Sex ratio of brown bears harvested in Subunits 14A and 14B, 1983-87.

Year	14A				14B				14A & 14B combined				Sex unknown	Harvest total
	M	(%)	F	(%)	M	(%)	F	(%)	M	(%)	F	(%)		
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
Total	6		4		17		11		23		15		3	41
Mean	1.2		0.8		3.4		2.2		4.6		3.0		0.6	8.2

Table 3. Distribution of brown bear harvest in Subunits 14A and 14B by major drainage, 1983-1987.

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	Total
14A											
Little Susitna R.	1	(14)	2	(20)	0	(0)	1	(13)	0	(0)	4
Palmer/Knik Arm	0	(0)	0	(0)	0	(0)	0	(0)	1	(11)	1
Matanuska R. (West Bank)	1	(14)	3	(30)	1	(0)	0	(0)	0	(0)	5
Total	2	(29)	5	(50)	1	(14)	1	(13)	1	(11)	10
14B											
Sheep R./Iron Cr.	0	(0)	4	(40)	2	(29)	3	(38)	5	(56)	14
Talkeetna R. (West Bank)	0	(0)	0	(0)	2	(29)	2	(25)	1	(11)	5
Sunshine Cr.	0	(0)	0	(0)	0	(0)	1	(13)	0	(0)	1
Montana Cr./Sheep Cr.	2	(29)	0	(0)	0	(0)	0	(0)	2	(22)	4
Kashwitana R.	3	(43)	1	(10)	1	(14)	0	(0)	0	(0)	5
Willow Cr./Little Willow R.	0	(0)	0	(0)	1	(14)	1	(13)	0	(0)	2
Total	5	(71)	5	(50)	6	(86)	7	(88)	8	(89)	31
Grand Total	7		10		7		8		9		41

Table 4. Brown bear hunter residency, Subunits 14A and 14B, 1983-1987.

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
	Total	9	(90)	1	(10)	10
	Mean	1.8		0.2		2.0
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
	Total	25	(81)	6	(19)	31
	Mean	5.0		1.2		6.2
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
	Total	34	(83)	7	(17)	41
	Mean	6.8		1.4		8.2

Table 5. Chronology of annual brown bear harvest in Subunits 14A and 14B, 1983-1987.

Subunit	Date	Year 1983 No.	1983 (%)	1984 No.	1984 (%)	1985 No.	1985 (%)	1986 No.	1986 (%)	1987 No.	1987 (%)	Total No.	Total (%)
	Sept. 1-8	1	(14)	3	(30)	0	(0)	0	(0)	0	(0)	4	(10)
	9-15	1	(14)	1	(10)	0	(0)	0	(0)	0	(0)	2	(5)
14A	16-22	0	(0)	1	(10)	0	(0)	0	(0)	1	(11)	2	(5)
	23-30	0	(0)	0	(0)	1	(14)	1	(13)	0	(0)	2	(5)
	Total	2	(29)	5	(50)	1	(14)	1	(13)	1	(11)	10	(25)
14B	May 16-20	0	(0)	1	(10)	2	(29)	0	(0)	0	(0)	3	(7)
Spring	21-25	0	(0)	0	(0)	1	(14)	0	(0)	0	(0)	1	(3)
	Total	0	(0)	1	(10)	3	(43)	0	(0)	0	(0)	4	(10)
	Sept. 1-8	1	(14)	0	(0)	1	(14)	1	(13)	3	(33)	6	(15)
	9-15	3	(43)	2	(20)	0	(0)	4	(50)	0	(0)	9	(22)
	16-22	0	(0)	1	(10)	2	(29)	2	(25)	2	(22)	7	(17)
14B	23-30	0	(0)	0	(0)	0	(0)	0	(0)	2	(22)	2	(5)
Fall	Oct. 1-8	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)
	16-31	1	(14)	1	(10)	0	(0)	0	(0)	1	(11)	3	(7)
	Total	5	(71)	4	(40)	3	(43)	7	(88)	8	(89)	27	(66)
	Grand Total	7		10		7		8		9		41	

STUDY AREA

GAME MANAGEMENT UNIT: 16 (12,445 mi²)

GEOGRAPHICAL DESCRIPTION: West side of Cook Inlet

BACKGROUND

Brown bears occur throughout Unit 16 and are most abundant in the foothills of the Alaska Range. Conservative hunting seasons prior to the 1984-85 regulatory year resulted in low harvests, but existing seasons have been responsible for a several-fold increase in harvests.

POPULATION OBJECTIVES

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

METHODS

Attainment of population objectives is evaluated by interpretation of harvest statistics (i.e., total harvest, sex ratios, age composition) and incidental observations by biologists and the public.

RESULTS AND DISCUSSION

Mortality

Season and Bag Limit:

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 1987 harvest of 93 brown bears equaled the record harvest for 1985 (Table 1). Harvest characteristics between the 2 years, however, differed in several ways. In 1987 more brown bears were taken from Subunit 16A (13 vs. 4) and fewer from Subunit 16B (79 vs. 88). The percentage of males declined from 66% to 59%, the mean age from 11.1 years to 9.2 years, and the mean skull size from 24.5 to 24.3 inches in 1985 and 1987, respectively. The percentage of breeding-age females (over 5 years) in the harvest increased from 9.4% to 13% in 1985 and 1987, respectively. No brown bears were reported taken in defense of life or property.

Hunter Residency and Success. The harvest by nonresidents has continued to increase, reaching over 58% of the total harvest for the first time since the liberal season dates were established (i.e., 1984-85).

Harvest Chronology. During the spring season, 38 brown bears were harvested; 68% percent of the harvest was reported in April. The earliest reported harvest occurred on 24 March; the peak of harvest occurred in the last 2 weeks of April. During the fall, 93% of the harvest (51 bears) occurred in September. The last reported harvest occurred on 28 October. The spring harvest was primarily composed of males; only 8 females were sealed, but during the fall season, 27 females were harvested, compared with only 22 males.

Transport Methods. Most successful brown bear hunters reported using aircraft for transportation: 94% (36) in the spring 68% (38) in the fall. Aircraft were more frequently used by successful hunters in Subunit 16B (85%) than in Subunit 16A (38%), where many hunters utilized the road system and then hunted by boat, all-terrain vehicle, or foot.

CONCLUSIONS AND RECOMMENDATIONS

The liberalizing of season dates in 1985 stimulated public interest in brown bear hunting. Harvest characteristics of spring and fall seasons were quite different. The greatest harvest increase occurred in the spring, because season dates included the most productive hunting period. Early spring snow conditions in many denning areas allowed access by ski-equipped aircraft when many mature male bears were emerging from dens. The predominance of harvested males and aircraft use during the spring season and the difference in mean ages of harvested males in the spring and fall (i.e., 9.0 and 4.9 years, respectively), reflect the early spring vulnerability of older males. Although brown bears continued to emerge from their dens after April, hunter effort and success dropped because of deteriorating snow conditions. Younger males and females characteristically emerge later in the spring than mature males. The number of bears (4) taken after 10 May (i.e., opening day of the spring season) was comparable to spring harvest levels prior to 1985. The liberalized season dates have increased nonresident harvest, because guides can now offer spring hunts with a high opportunity for success.

Extending the season dates into the fall has not significantly changed that harvest. Most of the harvest (93%) occurred during the September moose season. The variety of transportation methods reported during the fall was reflected by the incidental take of bears. Both males and females are active in the fall, and females are commonly taken.

Brown bears in the older age classes were common during in the 1985 season, and sealing data indicated the population had been lightly harvested prior to that time; however, since the seasons have been liberalized, the age structure of the harvest has changed. Younger

bears have been more frequently taken as older individuals have become less available. Data are lacking on the population size, but if the fall harvest patterns continue (i.e., exceeding 50% females), it may affect recruitment. Reduced recruitment will result in lower harvests and the reduction of older age classes. A predominance of younger bears in the harvest also occurs when a population is rapidly growing. Harvest parameters alone can not determine the actual population status. Observations of brown bears by both the public and staff suggest that harvests have not yet adversely affected the population.

At current harvest levels, the population should be able to maintain adequate recruitment to provide a reasonable opportunity for hunting success. Reductions in the spring season may be recommended, if data and field observations suggest reduced harvests are necessary to maintain the established population objective.

PREPARED BY:

James B. Faro
Game Biologist III

SUBMITTED BY:

Lawrence J. Van Daele
Acting Survey-Inventory Coordinator

Table 1. Annual brown bear harvests in Unit 16, 1983-87.

Year	No. males	No. females	No. unknown	Total	Mean male age	Mean male skull size (in)
1983	9	12	3	24	6.9	23.2
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

STUDY AREA

GAME MANAGEMENT UNIT: 17 (20,350 mi²)

GEOGRAPHICAL AREA: Northern Bristol Bay

BACKGROUND

No data on brown bear populations or annual harvests are available prior to 1961 for Unit 17. General long-term observations indicate that brown bear populations have been moderate to high for several years and have increased in this area during the past 10 years.

Prior to 1970 annual reported harvests were less than 15 brown bears. It was not until the Board of Game created alternate-year seasons in adjacent Unit 9 that interest in brown bear hunting developed in Unit 17. The Guide License and Control Board, created by the Legislature in 1973, implemented a system that divided the state into "guide areas." This action also increased hunting pressure for brown bears in Unit 17, an area where guides had not previously operated at significant levels. Annual harvests in the Nushagak Hills portion of Subunits 17B and 19B increased in the late 1970's. A radiotelemetry study of the Nushagak Hills brown bear population was proposed in 1980, but it was never funded.

Brown bear populations appear to have remained at relatively moderate-to-high densities throughout most of Unit 17 during the 1980's. Documented harvests of bears since 1961 in Unit 17 have been almost exclusively by sport hunters. However, in a presentation before the Board of Game, Behnke (1981) indicated that subsistence utilization of brown bears in the Togiak, Nushagak, and Iliamna drainages may be significant. A subsistence hunting season was first established in Subunits 17A and 17C for the 1986-87 regulatory year.

POPULATION OBJECTIVE

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

METHODS

Harvests are monitored by maintaining the mandatory sealing requirement for all harvested brown bears. Harvest data are obtained by determining sex, measuring skull size, and extracting a tooth at the time of sealing. The data are analyzed to determine if objectives are being met.

RESULTS AND DISCUSSION

Population Status and Trend

No data were available to evaluate the trend or population status of brown bears in Unit 17. General observations indicate relatively moderate-to-high densities of brown bears throughout most of the unit. Local residents have reported increasing densities during the past 5 years in Subunit 17C. Most sport hunting occurs in Subunit 17B, and Shepherd (1980) expressed the concern that high levels of hunting pressure in that area were leading toward an increased percentage of young bears in the population. This concern was supported by a trend toward an increasing proportion of >5-year-old bears in the annual harvest. Additionally, there has been a significant increase in the proportion of females in the harvest since 1980 (Fig. 1).

Mortality

Season and Bag Limit:

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

Human-induced Mortality:

The reported harvest was 55 brown bears in Unit 17 during 1987, including 22 males and 33 females. Twelve were taken in Subunit 17A, 41 in Subunit 17B, and two in Subunit 17C. Fifty-three were harvested by hunters, and two were taken in defense of life or property. No harvest was reported during the subsistence season. This is the 2nd-highest reported harvest in this unit, and it is exceeded only by that reported for 1985 (i.e., 57 bears).

Less than 15 brown bears per year were reported in the annual harvests in Unit 17 prior to 1970. The average annual harvest between 1970 and 1987 was 24.9 bears. In 1985 the annual harvest increased dramatically, when 57 bears were taken; it has remained high since. Between 1985 and 1987, annual harvests have averaged 54.3 bears.

Harvest Chronology. Most bears (84%) were harvested during the fall season, when 20 males and 23 females were killed. The harvest of all females in the fall occurred in September.

Hunter Residency. Thirty-one bears (61%) were taken by nonresidents. This is significantly below the unit average of 72%.

CONCLUSIONS AND RECOMMENDATIONS

Since 1984 hunting season dates have changed almost annually in most areas of Unit 17, making it difficult to evaluate the regulatory effects on the harvest. Prior to 1984, the open seasons were 10-25 May and 7-21 October; the bag limit was 1 bear every 4 regulatory years. Present seasons and bag limits are identical for all subunits in Unit 17 (i.e., 10-25 May and 10 September-10 October), except that a subsistence season is allowed in Subunits 17A and 17C from 10 April to 10 May. Most of the increased harvest during the past 2 years is due to the earlier fall season. The caribou and moose hunting seasons are open throughout the fall, and the first 6 to 11 days (i.e., depending upon area) of the brown bear season, respectively. Multiple-species hunts are extremely attractive for the guide, air taxi, and outfitter industries, and hunting in Subunit 17B has increased substantially because of these commercial operations.

The trend towards an increasing percentage of females in the harvest (Fig. 1) may be indicative of a declining population in Subunit 17B. Assuming a density of 1 brown bear per 15 mi^2 (Taylor 1986) and 5% as the optimum harvest level, Subunit 17B (approximately 7,500 mi^2) would contain approximately 500 bears and be capable of supporting an annual harvest of 25 animals. Harvests in Subunit 17B in 1985, 1986, and 1987 of 51, 45, and 41 brown bears, respectively, were probably excessive. I believe that the bear hunting seasons in September should be reduced in Subunit 17B.

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PREPARED BY:

Kenton P. Taylor
Game Biologist III

SUBMITTED BY:

Lawrence J. Van Daele
Acting Survey-Inventory Coordinator

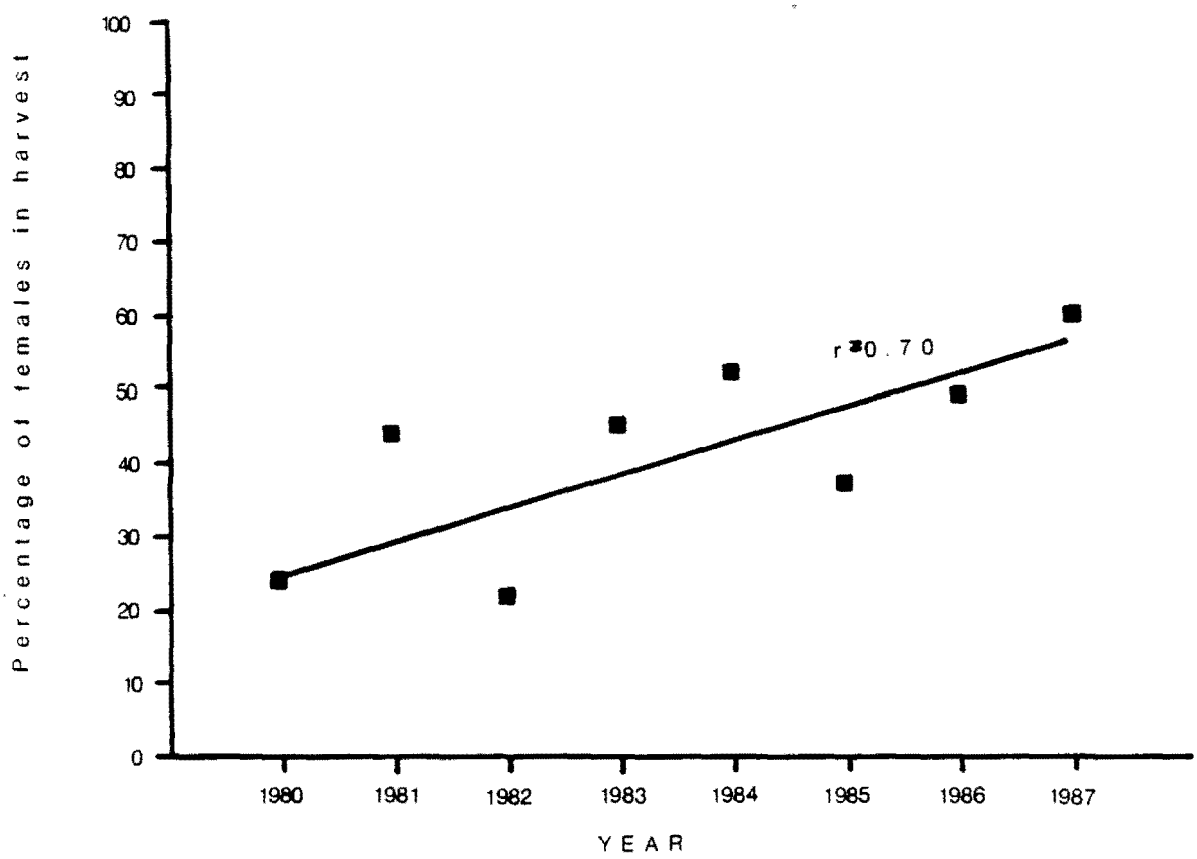

Figure 1. Unit 17, annual percentage of female brown bears in the harvest, 1980 - 1987.

STUDY AREA

GAME MANAGEMENT UNIT: 18

GEOGRAPHICAL DESCRIPTION: Yukon-Kuskokwim Delta

BACKGROUND

Grizzly bear densities in Unit 18 are moderate and the population is stable. Highest densities are found in the Kilbuck Mountains southeast of Bethel and in the Andreafsky Mountains north of the Yukon River. Annual harvests vary markedly, depending upon spring weather, snow cover, and the number of guides working in the area. Unreported harvest may exceed reported harvest in some years.

POPULATION OBJECTIVES

To establish population objectives for Unit 18.

To minimize adverse interactions between bears and the public.

METHODS

Incidental observations of grizzly bears were recorded by Department and U.S. Fish and Wildlife Service (USFWS) personnel during aerial and ground surveys of other species. Informal reports received from the public were compiled with interviews of local residents documenting bear distribution and the subsistence harvest. Harvest information received through the statewide grizzly bear sealing program was analyzed to determine location and sex and age composition of bears harvested during the year.

RESULTS AND DISCUSSION

Population Status and Trend

Based on the above methodology, grizzly bears in Unit 18 appear moderately abundant and the population is stable in areas having suitable montane and riparian habitat.

Population Size

Unit 18 contains approximately 11,000 mi^2 of fair- to excellent-quality grizzly bear habitat. Approximately 5,000 mi^2 lies in the Andreafsky Mountains and 6,000 mi^2 in the Kilbuck Mountains. When we applied density estimates derived from research studies conducted in northwestern and Interior Alaska to these 2 areas, we concluded the overall density of grizzly bears probably lies between 1 bear/16 mi^2 and 1 bear/35 mi^2. Based upon these density estimates, the grizzly bear population in Unit 18 numbers between 300 and 700 bears. I believe the actual population size is probably nearer the high end of the range, because the above estimates do not account for bears in the vast lowland of the

Yukon-Kuskokwim Delta, which is considered to be marginal habitat. Population size extrapolations based on density estimates from other areas of Alaska should be viewed with caution, because differences in habitat, climate, and food availability can greatly influence population density. Accurate estimation of population numbers awaits comprehensive research.

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 attract seasonal concentrations of bears and may support greater brown bear densities than found elsewhere in the unit. The forested riparian corridor of the Yukon River and tributaries of the Kuskokwim River probably support lower densities of bears than are found in upland habitats. The vast treeless lowland of the delta lying between the Yukon and Kuskokwim Rivers contains few bears, although they are occasionally sighted in upland areas near the Askinuk Mountains east of Cape Romanzof, the Kusilvak area south of Mountain Village, and around Nelson Island.

Mortality

Season and Bag Limit:

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

Human-induced Mortality:

The reported harvest of 5 bears annually in 1986 and 1987 for Unit 18 is a marked decrease from harvests reported in previous years. The harvest of bears increased sharply when guides began operating in the unit in 1979, and a record 24 bears were harvested in 1981. The recent reduced harvest is related to poor spring weather conditions that hindered back-country access and decreased guide activities.

Two males and 3 females and 4 males and 1 female were reported harvested in 1986 and 1987, respectively. Eight of the 10 bears reported in the last 2 years were from the Kilbuck Range, one was from the Andreafsky Mountains, and one was from the lower Yukon River area near Kotlik. Approximately 7 additional unreported brown bears were taken in the upper Kwethluk river drainage in 1987 for subsistence purposes. The subsistence harvest is usually not reported through the sealing program, because local residents are reluctant to provide written documentation of their hunting activities; however, they freely provide the information if personally interviewed. Grizzly bears are occasionally shot by local residents along the lower Yukon River but are rarely consumed. Bears killed in defense of life or property (DLP) are

only sporadically reported through the bear-sealing program. No DLP bears were reported taken during 1987.

A localized, intensive subsistence harvest was documented in the spring of 1985 when approximately 20 grizzly bears were taken in the immediate vicinity of the community of Goodnews Bay. Extensive shore-fast ice around Goodnews Bay created poor seal-hunting conditions for local residents. Complete snow cover in the adjacent mountains, however, allowed snowmobile access to bear denning areas, and grizzly bears were taken as they emerged onto snow-covered hillsides. Fortunately, such circumstances leading to excessive harvests have been rare. Grizzly bear harvests in Unit 18 probably have not depressed the population, although harvests in 1981 and 1985 may have approached the maximum-sustained yield; however, we cannot evaluate the population until better information concerning productivity, population size, and the magnitude of unreported harvest is available.

Hunter Residency and Success.

Nonresidents harvested three of the 5 bears reported in 1986 and four of the 5 bears reported in 1987. Local Kuskokwim area subsistence hunters may have harvested approximately 5 and 7 additional unreported bears in 1986 and 1987, respectively. The 1987 figure includes 2 bears harvested in the fall near Heart Lake (i.e., bordering Units 17 and 18).

Harvest Chronology. Reports indicate 1 and 4 bears were harvested in April and September, respectively. Two bears were harvested in May 1987, one in September, and two in October. The subsistence harvest usually occurs opportunistically during the spring months, when bears are encountered by hunters engaged in other activities.

Transport Methods. Nonresident hunters used aircraft for transportation in Unit 18, resident hunters used aircraft and boats, and subsistence hunters used snowmachines and boats. There has been little change in these transport methods during the last 5 years (1983-87).

Habitat Assessment

Unit 18 contains approximately 11,000 mi^2 of fair-to-excellent grizzly bear habitat in the Kilbuck and Andreafsky Mountains. Additional lowland riparian habitats support lower densities of grizzly bears along the Yukon River and tributaries of the Kuskokwim River. These lowland areas of deciduous and mixed deciduous-coniferous habitats are confined to riparian corridors surrounded by tundra. The grizzly bear habitat in Unit 18 is essentially at carrying capacity. Most grizzly bear habitat in Unit 18 is protected by the Yukon Delta National Wildlife Refuge, and land status is not expected to change.

Game Board Actions and Emergency Orders

In 1986 the Game Board extended the spring season from 10 to 25 May to 10 April to 25 May so that ongoing subsistence bear harvests could be legalized; the bag limit of 1 bear per hunter per year was established. Concurrent with this extension, the use of aircraft was prohibited from 10 April to 10 May. At the suggestion of the Department, aircraft restrictions were lifted for the 1987-88 regulatory year and the harvest was once again restricted to 1 bear every 4 years. The resident and nonresident seasons remained from 10 to 25 May. The fall season has not changed during the past 5 years.

CONCLUSIONS AND RECOMMENDATIONS

In Unit 18 grizzly bear densities are moderate and the population is stable. Annual harvests have varied markedly, depending upon spring weather, snow cover, and levels of nonresident and subsistence hunting. The highest reported harvests of 24 bears in 1981 predominantly involved nonresident hunters; approximately 20 bears were harvested by subsistence hunters in 1985.

Habitat for grizzly bears in Unit 18 includes both montane and riparian areas. The montane habitats appear excellent; however, the bear populations in lowland riparian corridors, particularly along the Yukon River, are not well understood. Census information is lacking for all areas. Management decisions have been based only on the reported harvest. The utility of such data would be enhanced, if actual harvest, population size, density, and habitat use were known. Grizzly bear research studies in Unit 18 remain a low priority because of current budgetary and manpower restrictions; however, USFWS staff may be willing to assist in gathering bear population data during their salmon spawning investigations; i.e., aerial stream surveys and track counts by boat.

The unreported harvest of grizzly bears by subsistence hunters in Unit 18 remains a major management problem, far surpassing those taken in DLP. Department personnel should continue informational and educational efforts that emphasize the need for compliance with the game regulations, including reporting of grizzly bear harvest.

PREPARED BY:

Samuel M. Patten, Jr.
Game Biologist III

SUBMITTED BY:

Steven Machida
Survey-Inventory Coordinator

STUDY AREA

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

GEOGRAPHICAL DESCRIPTION: All drainages of the Kuskokwim River upstream from Kalskag.

BACKGROUND

Although grizzly bears appear to be distributed throughout Unit 19, sport harvesting interest vary. Although there has been low-to-moerate harvest pressure in the higher elevations within the Alaska Range and Kuskokwim Mountains where guides are operating, it has been light in the other portions of the unit. Some incidental and unreported harvest of bears undoubtedly occurs in lower elevation areas within subunits 20A and 20D, especially around villages and fish camps.

MANAGEMENT OBJECTIVES

To provide a mean annual harvest of 30 grizzly bears including a minimum of 50% males.

To increase legal harvests of grizzly bears in and around villages, fish camps, and other human habitations during open seasons to reduce human-bear conflicts during closed seasons.

METHODS

No surveys designed to enumerate grizly bears have been conducted in Unit 19. Based on sealing documents, the harvest trend is reviewed annually, and regulations may be amended when harvest data indicate the need.

RESULTS AND DISCUSSION

Population Status and Trend

Because no formal surveys have been conducted, the trend of the Unit 19 grizzly bear population is unclear; from analyses of harvest data, it appears that present use of the population is moderate. Assuming that Pegau's (1987) estimate of 900 grizzly bears is reasonable, the 1987 reported harvest of 36 bears constitutes of about 4% of the population. At that level, the harvest probably will not cause a decline in the population. I suspect other factors, including habitat quality and unreported harvest, combine to keep grizzly bear populations in Unit 19 at relatively stable levels.

Hunter effort per bear killed also suggests stable bear abundance. From 1969 to 1986, 700 grizzly bears were sealed. Successful

hunters spent a mean of 5.5 hunting days per bear harvested (N = 3,853 days) . During the 1987 seasons, a total of 186 hunting days were reported by 36 hunters for an average of 5.17 days per successful hunter (Table 1). This number is not significantly different from previous years, perhaps lending further credence to the hypothesis that grizzly bears are as abundant as they were in the past.

Population Size:

A rough population estimate for Unit 19 was 900 bears (Pegau 1987). Although no surveys have been conducted since Pegau's study, similar estimates have been produced using reasonable density figures for different grizzly bear habitats. Subunit 19B probably contains the best habitat; densities are estimated at 1 bear/25 mi^2 (i.e. 300 bears). Subunit 19C has about 5,200 mi^2 of good habitat (1 bear/25 mi^2 = 210 bears) and 1,500 mi2 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 that probably has about 1 bear/50 mi^2, (i.e., 200 bears). The overall is 905 grizzly bears in Unit 19 (1 bear/41 mi^2)

Distribution and Movements:

Grizzly bears are widely distributed. As mentioned above, Subunits 19B and portions of 19C probably contain the best habitat and thus higher densities.

Mortality

Season and Bag Limit:

The open seasons for all huterss in Subunits 19A, 19C, and 19D are 10-25 May and 1 September to 10 October. The bag limit is 1 grizzly bear every 4 years, but the harvest of cubs and sows accompanied by cubs is prohibited. The open season for resident and nonresident hunters in subunit 19B are 10 September to 10 October and 10-25 May. there is no subsistence season in Subunits 19B and 19C.

Human-induced Mortality:

Following relatively low harvests throughout the 1960's (1961-1970 mean annual harvest = 15.2 bears), there was an increase through the 1970's (1971-1980 mean annual harvest = 53.7). From 1981 through 1987, reported harvests have been moderate, compared with the earlier 2 decades (mean annual harvest = 28.1 bears) (Figure 1). The majority of the harvest occurs in Subunits 19B and 19C; Subunits 19A and 19D provide lower annual harvests (Table 2).

Age of Harvested Bears. From the teeth of 35 grizzly bears harvested this year, mean age was calculated to be 8.8 $\pm$ 2.0 years (Table 6; Figs. 2 and 3). Although not statistically significant (Students t-test, P = 0.05), the trend since 1980 appears to be an increase in their mean age.

Sex Ratio in the Harvest. Because present harvest levels are low and impacts from hunting negligible, annual sex ratios of harvested bears have fluctuated. Although the proportion of males in the harvest has been near 60% (Table 7), it has fluctuated from a low of 29% (1966) to a high of 77% (1971) from 1961 to 1987. Generally, a preponderance of males in the harvest reflects a healthy population. I think that many Unit 19 hunters are harvesting grizzly bears during multispecies hunts and are not necessarily attempting to take a record-class specimen; therefore, more females are harvested. Until grizzly bear hunting effort becomes more intense in Unit 19, I feel that a management scheme designed to harvest greater than 50% males should provide the needed protection.

Illegal and unreported harvests are difficult to estimate, but in my opinion, they may be as high as 20-30% of the reported harvest. Problems with grizzly bears at villages and fish camps often lead to killing them in defense of life or property; however, hides and skulls are often not salvaged and this harvest remains undocumented. The majority of the undocumented harvest probably occurs in Subunits 19A and 19D.

Hunter Residency and Success. From 1961 to 1986, 850 grizzly bears were reported harvested from Unit 19. Of those, 681 (80%) were taken by nonresidents (Table 3), indicating a very active guiding industry in the unit. During 1987, 28 of 36 bears (78%) were taken by nonresidents, indicating no significant change in residency of successful hunters. Success rates of bear hunters in Unit 19 are unknown. Harvest data are based on hide and skull sealing documents, and there is no provision for documenting unsuccessful hunter effort.

Harvest Chronology. Most (84%) of the grizzly bears taken in Unit 19 from 1961 to 1987 were harvested during the fall seasons. Currently, a 15-day spring season is open during mid-May, but it appears few hunters have taken advantage of that season. During 1987, 6 bears were reported harvested in May (17% of the total 1987 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 there are no roads into Unit 19 from other areas, the majority of the brown bear harvest has been facilitated through air transportation. During the period 1969 to 1986, 616 of 704 (88%) successful hunters travelled to their areas by air. In 1987, 28 of 36 (80%) successful hunters used airplanes, consistent with earlier percentages. This method of transportation has remained relatively consistent from 1969 (when method of transport was first indicated on sealing documents) to 1987 (Table 5).

Habitat Assessment and Enhancement

As reflected in the locations where most brown bears are harvested (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 for the past 5 years; however, during the 1982-83 and 1983-84 regulatory years, hunting in Subunit 19B was limited by drawing permit; 9 spring permits were issued during each of those 2 years.

From 1983 to 1986 fall seasons in subunits 19A, 19C, and 19D were from 10 September to 10 October (30 days) i.e., in 1987 they were lengthened to 40 days (1 September through 10 October). This 10 day increase may be year may be at partially responsible for the increased harvest (from 25 in 1986 to 36 in 1987). From 1982 to 1987 in Subunit 19B, fall seasons have been from 10 September to 10 October; during the 1982-83 and 1983-84 regulatory years hunting was by drawing permit only.

CONCLUSIONS AND RECOMMENDATIONS

Because harvests have been modest and there are no apparent signs of decline in the population (i.e.,based on sealing data; mean annual ages of harvested bears, days per successful hunter, and sex ratios), I recommend that current regulations be retained. Brown bear predation on moose and caribou is not a widespread problem in the unit. I think that future harvests will continue to be between 30 and 50 bears annually, if current regulations continue.

Annual review of sealing certificate data will continue. If sex ratios in the harvest begin to favor females, changes in season lengths should be considered. Mean ages of harvested bears have fluctuated from year to year, but it appears that the older-age component of the population is remaining intact.

Personal contacts in communities and fish camps by ADF&G and Fish and Wildlife Protection personnel will continue to stress the need for documentation of sport harvests as well as those involving defense of life and property. Because of the present regulation requiring a $25.00 resident grizzly bear tag, compliance with reporting requirements by local residents is low. Allowing state residents to harvest a bear, and then obtain the necessary tag would, perhaps, increase reporting.

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PREPARED BY

Jackson S. Whitman
Wildlife Biologist III

SUBMITTED BY

Wayne E. Heimer
Survey-Inventory Coordinator

REVIEWED BY:

Harry V. Reynolds, III
Wildlife Biologist III

Table 1. Annual hunter effort (depicted as mean number of days hunted) by successful grizzly bear hunters in Unit 19, 1969-87.

Year	No. hunters	Mean days hunted
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
Total	700	5.58

Table 2. Annual harvest of grizzly bears in Unit 19, 1961-87.

Year	19A	19B	19C	19D	Total
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	15	--	16
1967	--	--	14	1	15
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	34	--	61
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	19	2	66
1980	7	31	17	2	57
1980	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
Total	81	307	439	60	887

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

Year	Residents	Non-residents	Unknown	% Non-residents
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	4	16	--	73
1971	6	21	1	72
1972	7	32	--	70
1973	14	48	1	76
1974	14	51	--	86
1975	8	39	--	91
1976	4	47	--	84
1977	9	40	--	87
1978	6	64	--	90
1979	7	55	--	82
1980	12	53	1	93
1981	3	32	--	84
1982	6	16	1	80
1983	3	30	--	86
1984	5	13	--	68
1985	6	17	--	71
1986	7	18	--	72
1987	8	28	--	78
1988	2	31	1	94
Total or Average	175	740	5	80

Table 4. Chronology of the harvest of grizzly bears from Unit 19, 1961-87.

Year	5	6	7	8	9	10	11	Total	Total in Spring
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
Total	118	20	2	2	626	110	8	886	16

Table 5. Reported method of transportation used by successful grizzly bear hunters in Unit 19, 1969-87.

Year	Method of transportation[a]							Total
	Airplane	Horse	Boat	3-wheel	Snow	ORV	Hwy	
1969	--	--	--	--		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
1796	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
Total	664	21	19	4	3	36	12	739

[a]Designation of methods of transportation to the hunting area included air, aircraft, 3-wheel, 3-wheeled off-road vehicle, snow machine, ORV, highway vehicle.

Table 6. Mean ages of grizzly bears harvested from Unit 19, 1968-87.

Year	Mean age	N	Standard error (= 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
1796	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

Table 7. Reported sex of harvested grizzly bears from Unit 19, 1961-87.

Year	No. males	No. females	No. unknown	% 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
Totals or Average	499	343	45	59

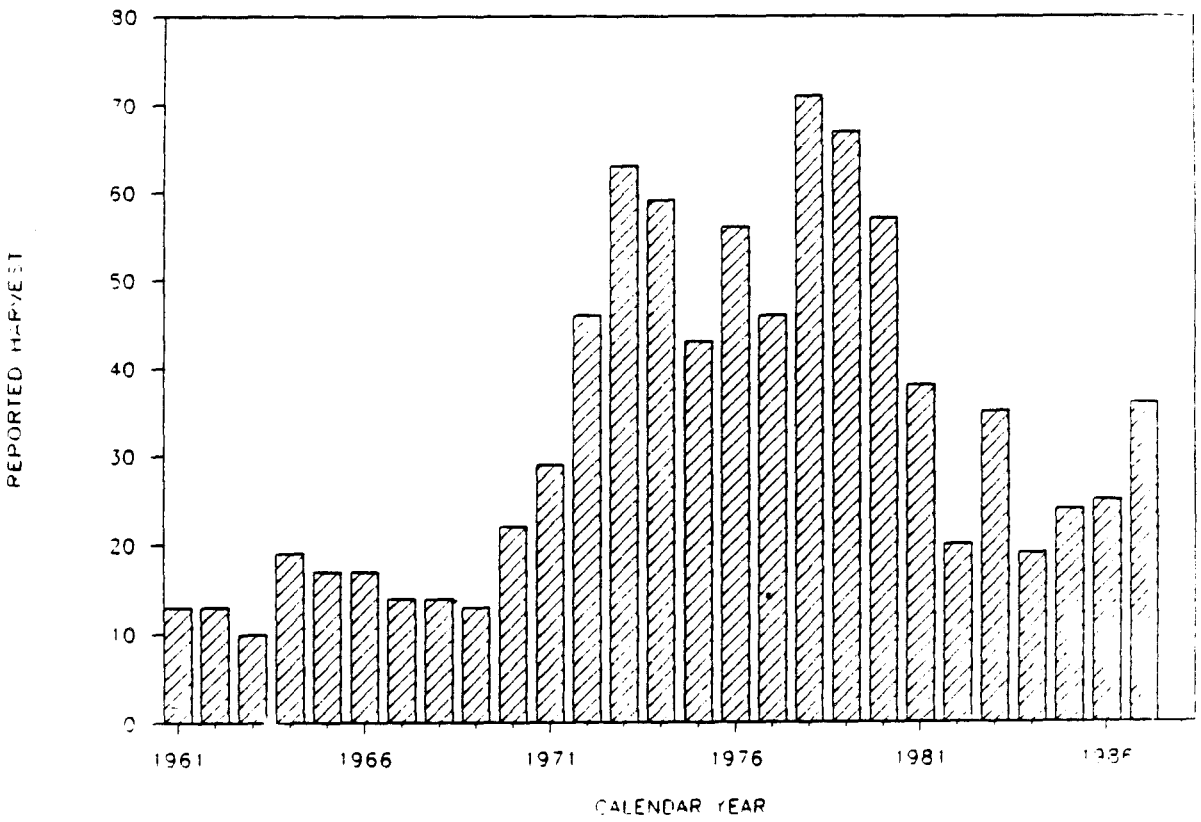

Figure 1. Reported harvest of brown/grizzly bears in Unit 19, 1961-87.

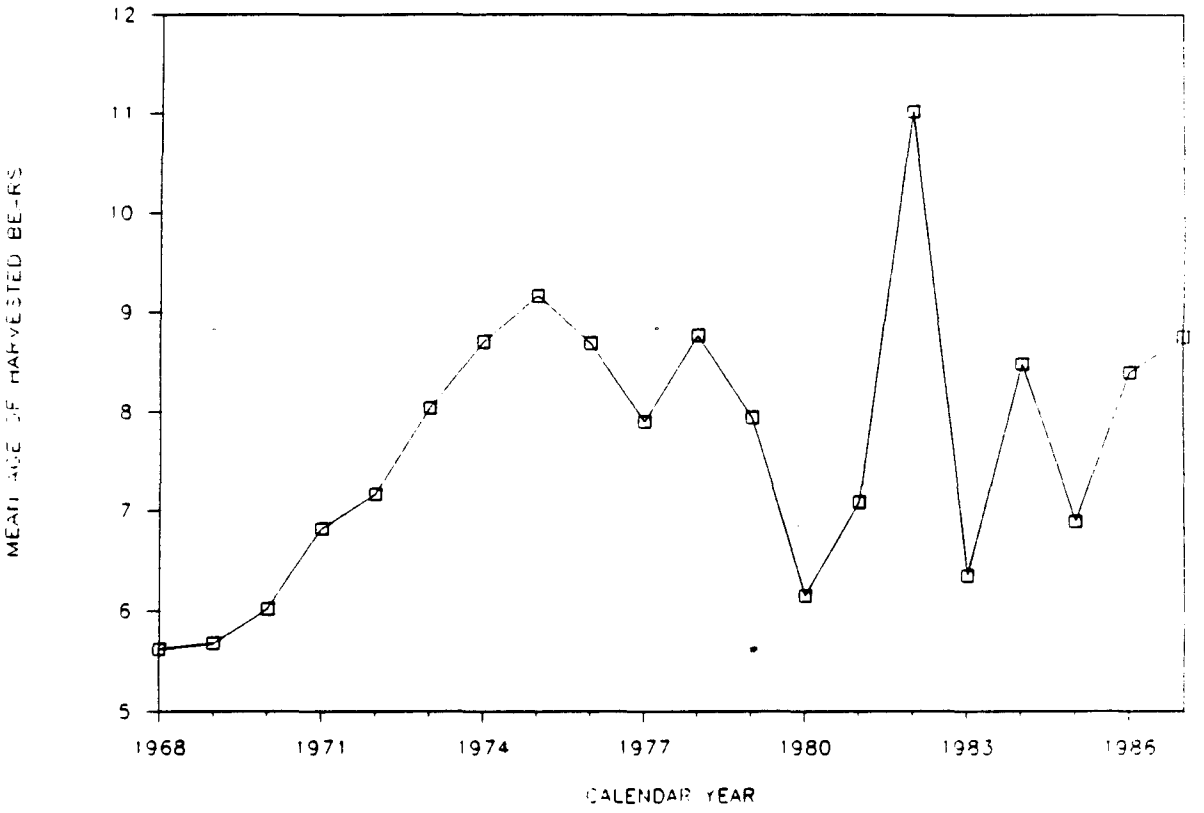

Figure 2. Mean ages of brown/grizzly bears reported killed in Unit 19, 1968-87.

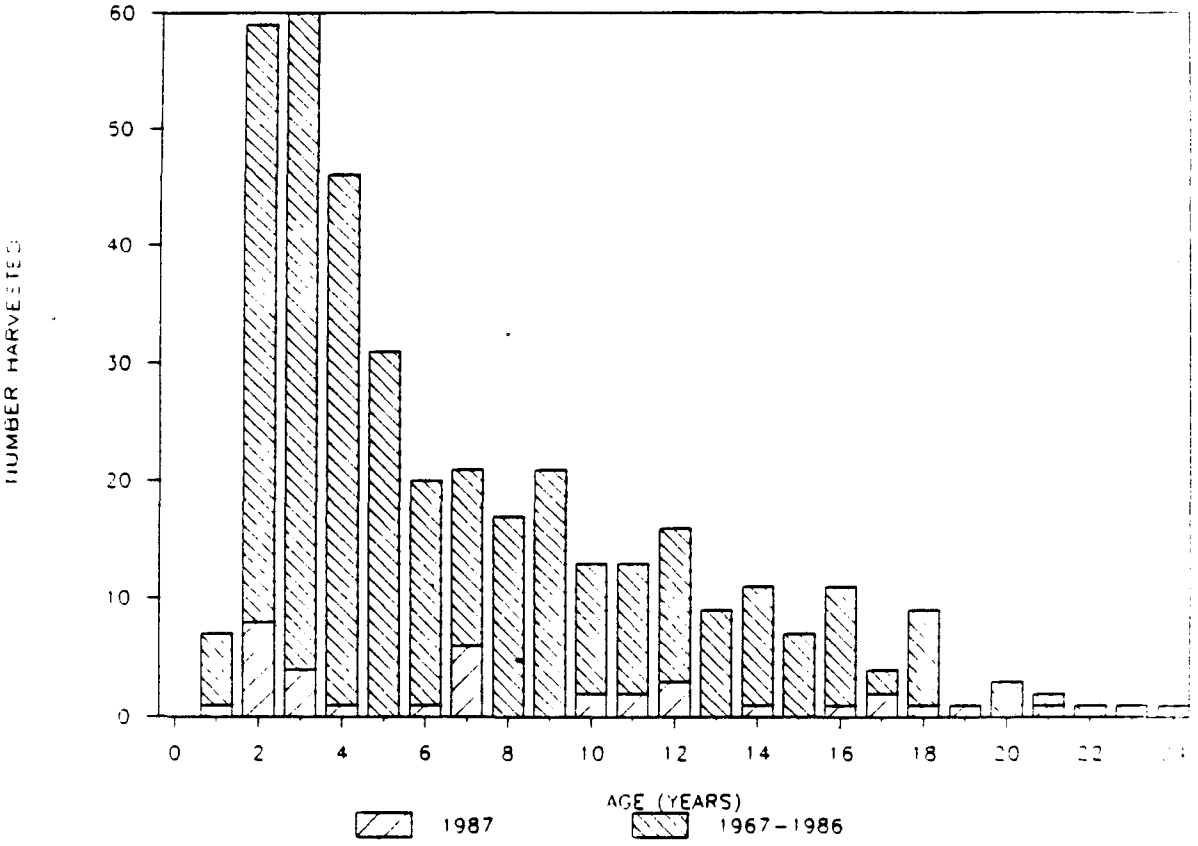

Figure 3. Numbers of brown/grizzly bears harvested in Unit 19, by age class, 1967-87.

STUDY AREA

GAME MANAGEMENT: Unit 20D (5,400 mi^2)

GEOGRAPHICAL DESCRIPTION: Central Tanana Valley near Delta Junction

BACKGROUND

Grizzly bears are distributed throughout Subunit 20D; however, not many studies have been conducted in this area. The management goal for Subunit 20D is to provide the greatest opportunity to participate in hunting. To meet this goal, grizzly bear seasons have been fairly liberal (Table 1).

MANAGEMENT OBJECTIVES

To provide a mean annual harvest of 12 bears, including a minimum of 60% males.

METHODS

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 harvest, and name, address, and residency of hunter. A premolar was also extracted from the 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/25 mi^2 and 1 bear/35 mi^2, resulting in an estimate of 154 to 216 grizzly bears.

The Subunit 20D population estimate was further subdivided into estimates for southern and northern Subunit 20D. Southern Subunit 20D, south of the Tanana River, has approximately 2,000 mi^2 of grizzly bear habitat; the population estimate for this area ranges from 57 to 80 grizzly bears. Northern Subunit 20D, north of the Tanana River, has approximately 3,400 mi^2 of habitat; the population estimate for this area ranges 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.

Mortality

Season and Bag Limit:

The open seasons 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 brown bear tag is required. The harvest of cubs and females accompanied by cubs is prohibited.

Human-induced Mortality:

Reported grizzly bear harvest in Subunit 20D totaled 10 bears during 1987 (Table 2), representing 5-6% of the estimated population. This harvest was slightly higher than the mean harvest of 7 bears/year for the previous 5 years but slightly below the harvest objective of 12 bears/year.

In 1987, 80% of the harvests were males (Table 2); this percentage is higher than the harvest objective of 60% males. The harvest percentage of male bears in 1987 was also higher than the mean harvest of 51% males for the previous 5 years.

Harvest Locations. Most grizzly bear harvests (90%) in Subunit 20D during 1987 occurred south of the Tanana River (Table 2). During the previous 5 years, 71% 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 receives greater hunting pressure from moose, caribou, and Dall sheep hunters.

Although the total grizzly bear harvest is below the harvest objective and represents only 5-6% of the estimated population, there is a significant difference between harvest rates in southern and northern Subunit 20D. Based on the population estimate for southern Subunit 20D, a harvest of nine may represent 11-16% of the grizzly bears in that area. The harvest of only one in northern Subunit 20D represents approximately 1% of the grizzly bears there.

Hunter Residency. Most successful hunters (i.e., 90%) in Subunit 20D are Alaskan residents (Table 3). Most resident hunters are probably killing bears while hunting for 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 1987, 80% of them were killed during that season (Table 4).

Transportation Methods. During 1987 most grizzly bear hunters used transportation classified as "other" on sealing documents (Table 5). This classification includes highway vehicles and 3-or 4-wheelers; both are popular methods of hunting in Subunit 20D. The use of airplanes has decreased since 1981. This reduction may reflect the increased popularity of 3- or 4-wheelers for hunting in southern Subunit 20D or the unavailability of an air taxi operator in Delta Junction during the 1986-87 reporting period.

CONCLUSIONS AND RECOMMENDATIONS

The grizzly bear harvest in Subunit 20D is below the objective (i.e., 12 bears/year); however, it appears to be slowly increasing. From 1983 to 1987, the mean harvest was 8 grizzly bears per year.

The increase in harvest (Table 1) would not ordinarily be a cause for concern; however, most of the harvest has occurred in southern Subunit 20D. This area has only about 40% of the grizzly bear habitat in Subunit 20D, and 80% of the grizzly bear harvest has come from there during the last 5 years (1983-87). Based on population size estimates and harvest rates, it appears that the grizzly bear population in southern subunit 20D is declining.

Although the harvest in southern Subunit 20D may be detrimental to the bear population, it significantly benefits the ungulate populations. Current objectives for moose and caribou in southern Subunit 20D are to increase the size of these populations; reduced grizzly bear predation should help achieve these objectives. 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 harvest in southern Subunit 20D; however, it must be balanced against the moose and caribou population objectives.

The grizzly bear harvest in northern Subunit 20D is low; consequently, the population is probably stable or increasing. Large numbers of predators, including grizzly bears, in northern Subunit 20D are probably responsible for the low survival of moose calves to 6 months of age. Current moose population objectives call for increasing the size of the moose population in northern Subunit 20D. Because of the low grizzly bear harvest there and the current moose population objectives for that area, measures should be taken to increase the harvest of grizzly bears. The most effective methods to increase hunter harvest of grizzly bears are to liberalize the bag limit from 1 bear/4 years to 1 bear/year and eliminate the resident bear tag requirement.

PREPARED BY:

Stephen D. DuBois
Wildlife Biologist III

SUBMITTED BY:

Wayne E. Heimer
Survey & Inventory Coordinator

REVIEWED BY:

Harry V. Reynolds III
Wildlife Biologist III

Table 1. Seasons and bag limits for grizzly bears in Subunit 20D from 1977 through 1988.

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 from 1976 through 1987 north and south of the Tanana River in Subunit 20D.

Year	S. of Tanana				N. of Tanana				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

Table 3. Residency of successful grizzly bear hunters in Subunit 20D from 1976 through 1987.

Year	No. resident hunters	No. nonresident hunters	Unknown
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

Table 4. Harvest of grizzly bears in Subunit 20D during the spring and fall hunting seasons from 1976 through 1987.

Year	Number 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

Table 5. Transportation methods of successful grizzly bear hunters in Subunit 20D from 1976 through 1987.

	Number of hunters (%)				
	Airplane	Off-road 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)

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 bear densities are found in spruce-dominant or mixed forests at low elevations. Moderate bear densities are found in foothill or mountainous terrain near and above treeline. Because 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 grizzly bears also impact moose and caribou populations in this study area; however, predation rates have not been investigated.

A 10-year study of grizzly bears that related changes in harvest rates to population dynamics was begun in the central Alaska Range of 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 hunting effects under harvest rates that 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 appear to be stable; they are managed accordingly.

MANAGEMENT OBJECTIVES

To sustain a mean annual exploitation rate of 10% to 15% of the estimated grizzly bear 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 10 bears and an average of at least 55% males in the harvest in subunit 20B.

To provide stable populations with a combined mean annual harvest of up to 20 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 harvested grizzly bears. Most bears were sealed in the ADF&G Fairbanks office; some were sealed in other Departmental 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. Bear numbers there have been slowly declining because of the high harvests in the area (Reynolds and Hechtel 1987).

Population Size:

Only 2 recent density estimates are available for grizzly bears in Interior Alaska: (1) Reynolds and Hechtel's (1987) estimate of 2.7 bears/100 mi^2 for a 1,500-mi^2 study area in Subunit 20A and (2) Boertje et al. (1987) estimate of slightly less than 3.0 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 black bear bait stations, the densities in Subunits 20B, 20C, 20F, and 25C are lower than those in Subunits 20A or 20E.

Population Composition:

Reynolds and Hechtel (1987) reported a spring 1986 total population of 29 males and 29 females in an Alaska Range study area (1500 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 less than 3 years old. The mean age of adult bears was 10.2 years for males and 11.5 years for females. The median ages for adult males and females were 7.5 and 11.0 years, respectively.

Since 1981 the mean litter size has been 2.1 cubs for 17 litters of cubs of the year. 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 of 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:

The mean range sizes in the Alaska Range study area from 1982 to 1985 was 400 mi^2 for adult males (n = 5) and 90 mi^2 for adult females (n = 18) (Reynolds and Hechtel 1986). Female subadults had

a tendency to remain near the maternal home range after weaning, while subadult males frequently moved away from the maternal home range.

Mortality

Season and Bag Limit:

In Subunits 20A, 20B, 20C, 20F, and 25C, the open seasons for all hunters are from 1 April to 31 May and 1 September to 30 November. The bag limit is 1 bear every 4 years. The harvesting of cubs or females accompanied by cubs is prohibited. There is no subsistence season in Subunit 25C.

Human-induced Mortality:

Hunters reported taking 32 grizzlies: 19 males, 12 females, and 1 of undetermined sex (Table 1). In addition, 6 bears (i.e., 3 males, 3 females) were taken in defense of life or property (Table 2).

The harvest during 1987 was similar to that for 1986 and not substantially different from the 1983-87 mean annual harvest (i.e., 36.6; Table 3). The grizzly bear harvests during the last 5 years (1983-8) have been stable.

Grizzly bears in Subunit 20A and the eastern portion of Subunit 20B have been subjected to the greatest hunting pressure. From 1983 to 1987, 52% and 17% of the total harvest came from Subunits 20A and 20B, respectively. The harvest rate in the Alaska Range portion of Subunit 20A contributed to the population decline that began in the early 1980's (Reynolds and Hechtel 1987). Reynolds and Hechtel (1987) estimated the harvest rate at 12.5% to 13.4% of the adult grizzly bear population ($\geq$2 years old) from 1981 to 1986. The mean reported harvest in eastern Subunit 20B (4,500 mi^2) from 1983 to 1987 was 6.2 bears/year, representing 5% of the adult population. Because recent harvests in eastern Subunit 20B have been slightly below the maximum allowable, the grizzly bear population has been stable.

Subunits 20C, 20F, 20B (west), and 25C compose 71% of the study area; however, they contribute only 31% to the grizzly bear harvest. Because grizzly bear densities in some portions of those subunits are probably equal to those in eastern Subunit 20B, I believe harvests in Subunits 20B west, 20C, 20F, and 25C are well below maximum sustainable levels.

The difference in harvest rates between the mountains of Subunit 20A and the remainder of the study area were reflected in the mean age of harvested bears and in the proportion of males in the harvest (Table 4). The mean age of all males taken during the last 5 years (i.e., 1983-87) in the Alaska Range portion of Subunit 20A was 4.7 years (n = 37). In the remainder of the study area, the mean age of harvested males was 8.0 years (n = 51).

Similarly, the mean age of females ($\underline{n}$ = 38) harvested in the Alaska Range portion of Subunit 20A between 1983 and 1987 was 5.6 years. The mean age of the female bears harvested in the remainder of the study area was substantially higher ($\underline{x}$ = 9.0 years, $\underline{n}$ = 29). the percentage of males in the 1983-87 harvest was also lower in the Alaska Range (49%) than in the remainder of the study area (64%) (Table 5). Although interpretation of declining mean ages in the harvest is not always straightforward, the results here suggest that the mean age and percentage of males in the harvest may be indicators of low or high exploitation rates (i.e., given sufficient sample sizes over time). Similar interpretation of changes observed between small annual harvests probably would be unreliable.

Hunter Residency and Success. Since 1983 most successful grizzly bear hunters in the study area have been local residents ($\underline{x}$ = 52%); 14% and 26% have been military and nonresidents, respectively. A breakdown of successful hunters by residency is given in Table 6.

Harvest Chronology. Fall grizzly bear harvests are generally larger than those in the spring, because many are incidentally taken by hunters seeking moose, caribou, or sheep. Since 1983 an average of 68% of the annual harvest has been taken during the fall (Table 7).

Transport Methods. Methods of transportation by successful grizzly hunters have not substantially changed during the last 5 years (Table 8). Aircraft provided the most popular means of access, accommodating an average of 37% of the successful hunters since 1983.

Natural Mortality:

From 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 ($\underline{n}$ = 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 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. Permit stipulations to mitigate those impacts are currently being drafted and will be presented to the Habitat Division and to the Bureau of Land Management.

Game Board Actions and Emergency Orders

During the last 5 years the spring grizzly bear season has been from 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 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 et al. 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 yield. Harvests in the remainder of the study area are below maximum sustainable yield.

Management plans will allow the independent regulation of harvest in each zone. Harvest criteria, such as mean age and the percentage of males, were established to help the manager decide if harvests were meeting or exceeding management goals. Because mean age data can be highly variable when sample sizes are small, I recommend harvest criteria be based on 3-year averages. For example, in subunit 20B (east), regulatory changes would be considered if the 3 most recent annual harvests averaged more than 10 bears or less than 55% males. Presently, harvests and population trends appear to be meeting the management objectives.

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

Management activities during the next regulatory year will include (1) Monitoring impact of expanded mining operations in Subunit 25C on grizzly bears; (2) sealing of harvested bears; (3) collecting information from area biologists statewide on the use and effectiveness of aversive conditioning on problem bears; (4) soliciting and compiling reports on grizzly bear distribution and abundance in Subunits 20B, C, and F, and 25C where formal surveys have not been conducted; and (5) applying results of ongoing grizzly bear research to management.

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PREPARED BY:

Mark E. McNay
Wildlife Biologist III

SUBMITTED BY:

Wayne E. Heimer
Survey-Inventory Coordinator

REVIEWED BY:

Harry V. Reynolds, III
Wildlife Biologist III

Table 1. Sex composition and seasonal distribution of the grizzly bear harvest in Subunits 20A, B, C, and F and 25C, 1983-87.[a]

	1983						1984						1985						1986						1987					
	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	5	2	0	5	5	1	3	3	0	9	9	2	0	0	0	2	5	0	5	3	0	9	7	0	3	2	0	8	7	0
20B	3	0	0	4	0	0	3	2	0	5	6	0	0	1	0	7	0	0	1	0	0	1	3	0	1	2	0	3	2	1
20C	1	1	0	2	2	0	0	0	0	4	0	0	0	0	0	2	1	0	1	2	0	0	2	0	2	0	0	3	0	0
20F	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0
25C	1	0	0	1	1	0	0	0	0	0	2	1	2	1	0	0	0	0	0	0	0	0	2	0	1	1	0	0	1	0
Totals	10	3	0	13	8	1	6	5	0	19	18	3	2	2	0	13	6	0	7	5	0	10	14	0	7	5	0	15	10	1

[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, 1983-87.

Year	Subunit 20C					
	20A	20B	20C	20F	25C	Total
1983	2	2	0	0	0	4
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

Table 3. Summary of annual grizzly bear harvests in subunits 20A, B, C, and F, and 25C, 1983-87.[a]

	1983		1984		1985		1986		1987		5-yr mean
	Harvest	% Males	Harvest	% Males	Harvest	% Males	Harvest	% Males	Harvest	% Males	harvest
20A	18	58	26	50	7	29	24	58	20	55	19.0
20B	7	100	16	50	8	88	5	40	9	50	9.0
20C	6	50	5	100	3	67	5	20	5	100	4.8
20F	1	100	2	50	2	100	0	--	1	100	1.2
25C	3	67	3	0	3	67	2	0	3	33	2.8
Total	35	68	51	52	23	65	36	47	38	58	36.6

[a] Includes bears killed in defense of life or property as reported in Table 4.

Table 4. Mean age and percentage males in the sport harvest summarized by areas with different harvest rates, 1983

Year	Subunit 20A (mountains) mean age Males (n)	Females (n)	% Males	Subunit 20B (east) mean age Males (n)	Females (n)	% Males	Remainder of study area Subunit 20A (flats), 20B (west), 20C,20F, and 25C mean age Males (n)	Females (n)	% Males
1983	6.0 (6)	5.3 (7)	50	7.3 (4)	-- (0)	100	10.5 (10)	8.34 (4)	71
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 (7)	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
1983-87 combined									
$\bar{x}$	4.7	5.6	49	6.9	10.1	65	8.8	8.3	63
SD	4.4	4.7		3.7	4.6		5.0	4.6	
n	37	38		20	11		31	18	

Table 5. Age and skull sizes of sport-killed grizzly bears among 3 harvest zones in Interior Alaska, 1983-87.

20A Mountains						20B East[a]						20A Flats, 20B west, 20C, 20F, 25C					
Males			Females			Males			Females			Males			Females		
Age	(yr)	Skull	Age	(yr)	Skull	Age	(yr)	Skull	Age	(yr)	Skull	Age	(yr)	Skull	Age	(yr)	Skull
2	(83)	--	5	(83)	19.2	12	(83)	--	11	(84)	20.1	7	(83)	--	4	(83)	19.4
21	(83)	25.6	4	(83)	20.3	7	(83)	22.3	9	(84)	21.3	19	(83)	23.6	14	(83)	22.8
6	(83)	21.2	6	(83)	21.6	2	(84)	--	9	(83)	22.8	9	(83)	22.8	9	(83)	20.2
2	(83)	19.6	1	(83)	18.5	9	(84)	24.1	10	(84)	21.9	12	(83)	22.6	14	(84)	21.4
4	(83)	23.6	2	(83)	18.4	2	(84)	20.8	15	(84)	--	7	(83)	24.1	5	(84)	20.1
5	(84)	20.4	14	(83)	19.4	6	(84)	23.8	9	(84)	18.1	15	(83)	23.6	1	(84)	15.7
2	(84)	--	9	(84)	--	8	(84)	20.9	11	(85)	20	3	(83)	18.8	6	(85)	20.6
4	(84)	19.5	2	(84)	17.9	3	(84)	18.0	12	(86)	21.9	3	(83)	18.9	13	(85)	21.1
8	(84)	22.5	12	(84)	20.3	4	(84)	17.6	18	(86)	20.6	14	(83)	25.1	5	(86)	19.6
3	(84)	17.8	--	(84)	16.8	8	(84)	24.3	3	(87)	17.9	7	(84)	--	2	(86)	14.6
3	(84)	19.3	10	(84)	21.3	2	(85)	19.0				9	(84)	21.8	11	(86)	20.0
3	(84)	18.9	2	(84)	17.4	8	(85)	22.0				2	(84)	--	10	(86)	21.3
8	(84)	25.4	4	(84)	19.9	7	(85)	23.1				7	(84)	24.7	4	(86)	--
4	(84)	20.4	3	(84)	18.2	12	(85)	25.4				4	(84)	21.0	11	(86)	20.5
3	(84)	20.6	4	(84)	17.5	8	(86)	24				5	(84)	21.0	13	(87)	20.5
2	(84)	16.6	17	(84)	22.0	2	(86)	18				7	(85)	19.4	16	(87)	20.5
7	(85)	23.5	3	(84)	17.8	13	(87)	24.8				6	(85)	22.8	5	(87)	18.3
3	(85)	19.5	3	(84)	17.0	13	(87)	24.0				2	(85)	16.3			
2	(86)	--	--	(85)	20.6	3	(87)	--				9	(85)	24.8			
4	(86)	20.8	3	(85)	20.9							5	(85)	21.6			
10	(86)	24.8	5	(85)	19.8							11	(85)	24.1			
14	(86)	23.9	2	(85)	16.1							16	(86)	23.1			
2	(86)	16.2	2	(86)	16.5							3	(86)	20.4			
4	(86)	20.1	8	(86)	20.4							15	(86)	23.8			
5	(86)	20.6	2	(86)	17.4							3	(87)	18.4			
2	(86)	18.5	3	(86)	19.1							13	(87)	25.1			
1	(86)	18.2	6	(86)	20.8							3	(87)	20.4			
2	(86)	18.7	14	(86)	20.5							13	(87)	23.5			
7	(86)	23.4	2	(86)	15.5							15	(87)	23.8			
--	(87)	23.9	2	(86)	17.9							12	(87)	23.6			
3	(87)	19.5	2	(86)	17.9							--	(87)	25.0			
3	(87)	19.5	7	(86)	20.1												
2	(87)	17.5	6	(87)	21.6												
2	(87)	18.3	6	(87)	20.9												
17	(87)	24.0	2	(87)	17.6												
2	(87)	18.6	3	(87)	21.8												
			9	(87)	21.8												
			2	(87)	17.9												

Table 5. continued

20A Mountains						20B East[a]						20A Flats, 20B west, 20C, 20F, 25C					
Males			Females			Male			Female			Male			Female		
Age	(yr)	Skull	Age	(yr)	Skull	Age	(yr)	Skull	Age	(yr)	Skull	Age	(yr)	Skull	Age	(yr)	Skull
x:																	
4.7		20.5	5.6		19.2	6.9		22.0	10.1		20.4	8.7		22.5	8.3		19.9
SD:																	
4.4		2.6	4.7		1.8	3.7		2.6	4.6		1.5	5.0		2.5	4.6		2.03
N:																	
37		34	38		39	20		17	11		9	31		29	18		17

[a]20B (east) defined as that portion of 20B east of a line drawn north from Fairbanks through Haystacks Mountain.

Table 6. Residency of successful grizzly bear hunters, sport harvest only, 1983-87.

Year	Military res.	Local res.[a]	Nonlocal res.	Nonres.
1983	4	15	3	7
1984	7	24	5	11
1985	3	8	1	7
1986	6	18	1	6
1987	5	17	4	7

[a] Local residents 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 7. Chronology of sport harvest for Subunits 20A, 20B, 20C, 20F, and 25C combined, 1983-87.

Season	1983		1984		1985		1986		1987	
	M	F	M	F	M	F	M	F	M	F
Spring										
1 Apr-30 Apr	1	1	1	0	0	0	2	0	2	0
1 May-15 May	2	1	3	2	1	1	0	0	1	1
16 May-31 May	7	1	1	3	1	1	4	5	3	2
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	0	0	1
Summer										
1 July-15 Aug										
Fall										
15 Aug-31 Aug	1	0	0	0	0	0	0	0	0	0
1 Sep-15 Sep	2	1	14	10	4	2	8	9	9	8
15 Sep-30 Sep	8	6	5	4	4	3	2	5	3	1
1 Oct-15 Oct	1	1	0	2	1	1	0	0	1	0
16 Oct-30 Oct	0	0	0	1	0	0	0	0	0	0
1 Nov-30 Nov	1	0	0		1	0	0	0	0	0

Table 8. Transport methods of successful sport hunters, Subunits 20A, 20B 20C, 20F, and 25C combined, 1983-87.

Year	Airplane	ORV	Boat	Horse	Other (3 Wheeler or highway vehicle
1983	11	6	0	6	9
1984	15	7	6	5	12
1985	8	2	0	1	10
1986	14	4	3	5	9
1987	14	7	2	7	8

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

Research conducted in the mid-1980's demonstrated that grizzly bears and wolves are limiting moose population growth in Subunit 20E (Boertje et al. 1987). With an estimated density of 16 bears/1000 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 is greatest in spring (1 kill/26 bear days), lowest in simmer (1 kill/132 bear days), and intermediate in fall (1 kill/43 bear days)(Boertje et al. 1987). Adult female grizzly bears without cubs of the year also killed adult moose and caribou as well. Therefore, grizzly bear management in Subunit 20E addresses the strategic bear management goal as well as the ungulate predation problem 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 bear populations.

MANAGEMENT OBJECTIVES

To effect temporary reductions in the extent of grizzly bear predation where it is limiting moose population growth.

To sustain harvests of at least 25 grizzly bears.

To reduce bear harvests and stabilize and/or increase grizzly bear populations after moose populations have increased to desired levels.

METHODS

All brown/grizzly bears taken in Subunit 20E must be sealed within Unit 12 or Subunit 20E or in Tok. Harvest data are compiled from sealing documents, and ages are determined from extracted premolar teeth.

RESULTS AND DISCUSSION

Population Status and Trend

Grizzly bear numbers in Subunit 20E probably increased throughout the 1960's and 1970's because of the cessation of federal predator

control efforts at statehood and the protection afforded by conservative bear hunting regulations since then. The grizzly bear population is believed to have remained roughly stable during the 1980's, with the possible exception of bears inhabiting more accessible areas where recent harvest have been concentrated.

Population Size:

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

Population Composition:

No estimate of grizzly bear population composition in Subunit 20E can be made based upon harvest statistics because of biases inherent in the data collection process; however, Boertje et al. (1987) estimated population composition as follows: 10 males $\geq$6 years old, 12 females $\geq$4 years old without young, 6 females with 14 cubs of the year, 3 females with older offspring, and 15 subadults.

Distribution and Movements:

Based upon incidental observations and sealing documents, grizzly bears inhabit all portions of Subunit 20E. There seems to be a general seasonal movement by bears to lowland, riparian areas in early spring. Bears occupy all areas during summer; during the fall they move to subalpine areas as berry crops ripen. No seasonal bear concentration areas are known to occur in Subunit 20E, in contrast to other areas where brown/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 of 1 bear every 4 years in other units; however, no person may take more than 1 bear in Alaska per regulatory year. Cubs and females accompanied by cubs are protected by regulation.

Human-induced Mortality:

Twenty-four grizzly bears were harvested in Subunit 20E during 1987, compared with the 5-year mean harvest of 20 bears (Table 1). Since bear hunting regulations and moose and caribou seasons were liberalized significantly in 1981, the grizzly bear harvest has averaged 19. Prior to these changes, grizzly bear harvests averaged only 3 bears/year. This represents a 7-fold increase in annual harvest.

Of the 24 bears taken, 14 (58%) were males and 10 (42%) were females (Tables 1 and 2). There is no evidence of a trend in the sex composition of the harvest during the past 5 years. Eight (57%) of 14 males and four (57% of 7 females were ≥5 years old. There has been no clear trend in the proportion of either adult males or females in the harvest during the past 5 years (Table 2).

Approximately two-thirds of the harvest (n = 15) came from the Charley, Seventymile, and Middle Fork Fortymile River drainages in northwestern Subunit 20E. In the remaining area, 4 bears were harvested from the West fork of the Fortymile River, two from the Mosquito fork, and one each from the Dennison Fork, the lower Fortymile River drainages, and Mount Warbelow.

Hunter Residency and Success. Resident hunters harvested 22 grizzly bears (92%), while nonresidents took only two (8%). There is no means of determining hunter successs, because unsuccessful grizzly bear hunters are not required to report.

Harvest Chronology. Six grizzly bears (25%) were taken during the spring, and 18 (75%) were taken during fall; five were taken in May, one in June, seven in August, 10 in September, and one in October. The first grizzly bear of the year was taken on 9 May and the last on 8 September. In Subunit 20E most fall grizzly bears taken in Subunit 20E are incidentally harvested by moose and caribou hunters.

Natural Mortality:

According to Boertje et al. (1987), predation by adult male bears on sows and cubs was the major cause of natural mortality in Subunit 20E. In 1986 the natural mortality rates for cubs of the year was 60% (6 of 10). We observed 2 cases in which adult females with cubs of the year had been killed and consumed by adult males. In 3 of 4 instances 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. Habitat in Subunit 20E is lacking in food items, such as ground squirrels or spawning salmon, that are more abundant in areas supporting higher bear densities. Even ungulate prey densities are low, compared with their abundance in the 1960' and early 1970's. Low ungulate density may also explain why grizzly bears in Subunit 20E kill more big game prey than they scavenge (Boertje et al. 1987).

Enhancement:

An interagency fire management plan for the Fortymile River area designates over 60% of Subunit 20E as limited action; i.e., let burn. This will ensure a more natural fire regime in the area than has existed for the past 30 years, and 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 salmon run strength is less likely, given the historical and present interest in placer gold mining in Subunit 20E.

Game Board Actions and Emergency Orders

Before 1978 grizzly bear hunting regulations in Subunit 20E were conservative; i.e., relatively short seasons, 1 bear per 4 regulatory years bag limit, and a $25 resident tag requirement. Furthermore, the moose season was closed and the caribou season was short (i.e., 1-15 September) and limited to bulls as of 1977, resulting in fewer hunters afield during fall.

Since 1978 the bear season has been lengthened, the bag limit liberalized to 1 bear per year (1982), and the resident tag requirement waived (1984). Restoration of a moose season in 1982 and progressive liberalizations of the caribou season beginning in 1982 were also important factors contributing to the increased bear harvest. These changes increased fall hunting pressure and grizzly bear harvests dramatically, and most were made with that intention so that predation on ungulates would be decreased. The whole regulatory package increased grizzly bear harvests as intended, but it is difficult to assess the effectiveness of any single regulatory change because of the rapidity in which they were implemented.

CONCLUSIONS AND RECOMMENDATIONS

The strategic management goal of providing maximum opportunity to participate in hunting grizzly bears in Subunit 20E is currently being met. The only restrictions on hunting are the short closed season and the prohibition on taking cubs and females with cubs. Annual harvests have not yet reached the management objective of 25 bears harvested each year. It is unlikely that bear density has been sufficiently reduced to increase ungulate survival, except in a few localized area such as the upper Middle Fork of the Fortymile River where access by light aircraft is good, visibility is good, and increased levels of bear hunting have occurred in recent years. Additional harvest liberalizations will be needed to achieve the objective of reducing predation. Examples of regulatory changes that might achieve that objective include allowing (1) the harvest of grizzly bears on the same day a hunter is airborne, (2) bait, or (3) the harvest of cubs and/or sows accompanied by cubs. Such regulatory changes, however, are considered socially unacceptable. It is also possible that incidental harvests of bears by caribou

hunters would increase, if the Fortymile Caribou Herd grows enough to allow for increased hunting opportunities.

Bear predation on ungulates might also be reduced by supplemental feeding of bears in the vicinity of concentrated moose and caribou calving areas in late May and early June. Present evidence suggests that such a program was successful in the Mosquito Flats moose calving area in 1985 (Boertje et al. 1987). Yet another possibility would be to administer contraceptives (e.g., progesterone implants) to bears, which in combination with present harvests could serve to reduce bear numbers in specific ungulate calving areas.

In conclusion, management of ungulates and their ungulate predators, including grizzly bears, must be coordinated if Subunit 20E is to regain and maintain its historic productivity. Ungulates currently exist at low densities, and predators are sufficiently abundant to maintain these low densities. I recommend that annual harvests of ungulates remain conservative, while those of grizzly bears be increased to achieve management objectives for all species. In the long term, harvests of both predators and prey should be based upon the populations of all big game species in the area, while providing reasonable hunting opportunities.

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PREPARED BY:

David G. Kelleyhouse
Wildlife Biologist III

SUBMITTED BY:

Wayne E. Heimer
Survey-Inventory Coordinator

REVIEWED BY:

Harry V. Reynolds, III
Wildlife Biologist III

Table 1. Harvests of grizzly bears in Subunit 20E, 1983-87.

Year	No. harvested			No. males		No. females		No. spring	No. fall
	Total	Res.	Nonres.	Total	≥5 years	Total	≥5 years		
1983	20	17	3	13	5	6	4	7	13
1984	20	16	4	10	3	10	5	3	17
1985	12	8	4	10	7	2	2	6	6
1986	22	21	1	12	6	10	7	9	13
1987	24	22	2	14	8	7	4	6	18
$\bar{x}$	20	17	3	12	6	7	4	6	13

Table 2. Characteristices of hunter residence and grizzly bear harvests from Subunit 20E, 1983-87.

Year	No. taken	Percent taken		Percent males		Percent females		Percent	
		Res.	Nonres.	Total	≥5 years	Total	≥5 years	Spring	Fall
1983	20	85	15	68	38	32	80	35	65
1984	20	80	20	50	38	50	56	15	85
1985	12	67	33	83	88	17	100	50	50
1986	22	95	5	55	55	45	78	41	59
1987	24	92	8	67	57	33	57	29	71
$\bar{x}$	20	84	16	65	55	35	74	34	66

STUDY AREA

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

GEOGRAPHICAL DESCRIPTION: Middle Yukon River, including drainages of the lower Koyukuk, Innoko, Nowitna, and Meloozitna Rivers

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, and annual harvests have been less than 10 bears per year.

MANAGEMENT OBJECTIVES

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

METHODS

Hunters were required to have grizzly bears sealed at an ADF&G office. Data collected included sex, skull length and width, transportation used by the hunter, date and location of harvest, and name, address, and residency of hunter. A premolar was also extracted from the skull for use in age determination.

RESULTS AND DISCUSSION

Population Status and Trend

Based on the number of bears observed by ADF&G staff, reports of bear sightings by hunters, and the number of nuisance bear reports coming into the Galena office, the population is stable or slowly increasing.

Population Size:

No surveys have been conducted in the area; however, rough population estimates have been made, based on bear densities found in similar habitats in Interior Alaska. 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 320-360 bears. The best bear habitat is found in the Nulato Hills and throughout Subunit 21C.

Mortality

Season and Bag Limit:

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

and 1 September to 10 October. The bag limit is 1 bear every 4 years. Cubs and females accompanied by cubs are protected from harvest by regulation. Beginning in 1987, the $25 tag fee was required; it had been set aside for 1985 and 1986.

Human-induced Mortality:

Hunting pressure on grizzly bears remains low, despite progressively lengthened seasons. The length of the season increased from 47 days in 1981 to 129 days in 1982. From 1984 to 1986, it was 139 days; the present season is 180 days long. Unit 21 produces large bears; 13 of the 75 bears harvested during the last 10 years have qualified for Boone and Crockett Club records.

During 1987 only 6 grizzly bears were harvested by recreational hunters, and one was reported killed in defense of life or property (Table 1). The number of bears harvested by local residents at fish camps is not known, but I think it equals the reported harvest. Consequently, the harvest by humans is estimated at 10 bears, representing less than 3% of the estimated population.

Hunter Residency and Success:

There is no set pattern of harvest among user groups (Table 1). Almost all grizzly bears harvested during the fall are incidentally shot by moose hunters. The locations where bears are taken varies widely from year to year.

Game Board Actions and Emergency Orders

During the past 5 years, Board Of Game actions have lengthened the seasons and deleted the $25 tag fee for 1985 and 1986. These changes were made to (1) increase reporting rates by low-income license holders, (2) allow increased incidental grizzly bear harvest, and (3) increase the legal harvest of spring grizzly bears, thus lowering the likelihood of them being killed in defense of life or property (primarily at fish camps).

The reported grizzly bear harvest did not increase as expected. The mean reported harvest for the last 10 years is 7 grizzly bears per year; the reported annual harvest over the last 5 years is still 7 grizzly bears (Table 1). There is no indication that fewer bears are being taken in defense of life or property.

One reason the liberalized regulations have failed to produce a change in the reported harvest is probably related to Athapascan beliefs about grizzly bears. These beliefs discourage the presence of bear carcasses near their homes and discourage women from eating bear meat or coming in contact with bear hides.

CONCLUSIONS AND RECOMMENDATIONS

The management objective for grizzly bears within Unit 21 is to allow a minimum harvest of 10 bears annually. Based on sustainable harvest rate of 4-10% elsewhere in Interior Alaska, the estimated annual reported and unreported harvest of about 3% is below the estimated sustainable harvest of 20-60 bears. Unless the resident tag fee requirement is waived and hunting habits change, the harvest by humans will have a negligible effect on the grizzly bear populations in Unit 21. I recommend the tag fee be removed.

PREPARED BY

Timothy O. Osborne
Wildlife Biologist III

SUBMITTED BY

Wayne E. Heimer
Survey-Inventory Coordinator

REVIEWED BY

Harry V. Reynolds, III
Wildlife Biologist III

Table 1. Grizzly bear harvest statistics for Unit 21, 1983-1987.

Year	Total	Males	Females	Unk	Resident hunters	Non-resident hunters	Defense of life or property	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

STUDY AREA

GAME MANAGEMENT UNIT: 22 (23,000 mi²)

GEOGRAPHICAL DESCRIPTION: Seward Peninsula

BACKGROUND

The Seward Peninsula grizzly bear population was severely depleted during the early 1900's, when activities associated with gold mining and reindeer herding resulted in excessive killing of bears. Intensity of these activities decreased substantially during the mid-1940's, and bear numbers recovered, reaching pre-1900 levels in the 1960's. Incidental observations made by staff while conducting other field activities and reports from local residents indicate that bears in Unit 22 are now abundant.

Currently, interest in harvesting grizzly bears by nonresident and local recreational hunters (i.e., primarily from the Nome area) is high. If renewed activity in mineral exploitation and reindeer herding is not controlled, increased conflicts between bears and humans and a reduction of bear numbers, similar to what occurred during the early 1900's, could result. Increased monitoring will be required to insure overharvesting of this species does not occur.

POPULATION OBJECTIVES

To protect, maintain, rehabilitate, enhance, and develop the grizzly bear resource and habitat.

To provide for the optimum sustained use, both consumptive and nonconsumptive, of the grizzly bear resource, 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.

To monitor the harvest through mandatory sealing of hides and skulls.

METHODS

Harvest documentation in the Unit comes primarily from 2 sources: (1) sealing of bears taken during established hunting seasons and (2) reporting of bears killed in defense of life or property. Specific surveys to determine composition or size of the grizzly bear population in Unit 22 have never been done. Limited

observations are recorded annually during surveys for other game species and from general conversation with local residents.

RESULTS AND DISCUSSIONS

Population Size

The size of the grizzly bear population in Unit 22 is unknown. When applied to the entire Seward Peninsula, bear density estimates calculated for portions of Units 13, 20A, and 26 result in a total population estimate ranging from 288 to 1,150 bears. It is questionable whether bear population estimates derived from studies conducted in other parts of Alaska can be usefully applied to the Seward Peninsula, because of significant differences in topography, climate, food availability, and habitat. In addition, the resulting range of estimates is too broad to have much utility for management.

Mortality

Season and Bag Limit:

The open seasons in Subunit 22C for subsistence, resident, and nonresident hunters are from 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 from 1 September to 31 October and 1 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 Mortality:

The 1987 reported harvest was 42 bears (Table 1). With the exception of 1 male bear, all were assumed to be taken legally. This lowest-recorded harvest since 1983 may be attributed to (1) a reduction in the length of the spring season in Subunit 22C, (2) inclement travel and weather conditions during the spring, and (3) the reintroduction in the fall of 1987 of the resident tag fee. Eight additional bears were killed during 1987. Seven bears were reportedly taken in defense of life or property (DLP), and the remaining bear was found dead in a village dump; consequently, the known 1987 harvest for Unit 22 was 50 bears.

Based on information received from unit residents, it appears that many harvested bears were not sealed and some hides and skulls of bears taken in defense of life or property were not surrendered to ADF&G. I estimate an additional 10 to 30 bears are killed, but not reported, each year.

Overall, the reported harvest in Unit 22 from 1961 through 1987 was composed of 70% males and 30% females. In 1987, 25 males (60%) and 17 females (40%) were harvested. Mean age of harvested bears was 6.9 years (n = 40): 8.1 years for males (n = 24) and 5.2 years for females (n = 16). Twenty-two bears (55%) were 5 years old or younger, 12 bears (30%) were 6-10 years old, and 6 bears (15%) were 11 years old or older.

Historical location of harvest by subunit is given in Table 2. As in past years, a large percentage of the 1987 harvest (86%) came from Subunits 22A and 22B.

Hunter Residency and Success. Alaska residents took 52% (22) of the legal harvest (Table 1). Nine bears were taken during the spring season, and the remaining 13 were harvested during the fall. Nonresidents accounted for 48% (20) of the legal harvest; 13 and 7 bears were harvested in the spring and fall, respectively.

Because unsuccessful resident hunters are not required to report, no data are available for resident hunter success; however, information on hunter success is available for nonresident hunters with drawing permits for Subunits 22B, 22C, 22D, and 22E. During the 1987 spring hunt, 8 nonresidents hunted and seven of them killed bears. During the 1987 fall hunt, 5 nonresidents hunted and two of them killed bears.

Permit Hunts. During the past 4 years, nonresidents have demonstrated considerable interest in hunting bears in Unit 22 (Table 3). During the spring of 1987, 9 of 10 nonresident permits were drawn and the additional permit was issued to a local guide for an additional hunter. Twelve people applied for the 10 permits available in the fall.

Harvest Chronology. Except for 1976 and 1983, the spring bear harvest in Unit 22 (1975-1987) has exceeded the fall harvest (Table 4). Hunters generally favor the spring, because snow machines can be used to efficiently access hunting areas.

Game Board Actions and Emergency Orders

Known annual harvest of bears in Unit 22 was low until 1979, when favorable spring weather, a season liberalization, and increased interest by guides and nonresident hunters caused a dramatic increase. Prompted by Departmental concern over potential overharvesting, the Board of Game implemented a drawing-permit system for nonresidents in 1980. This regulation reduced the annual bear harvest during 1980-1983 to 31 or fewer bears. Subsequent actions by the Board deleted the nonresident permit requirement for Subunit 22A (1982), lengthened the spring season unitwide (1983), and eliminated the resident tag fee requirement (1984). These liberalizations resulted in increased hunter effort and a harvest exceeding 50 bears annually (Tables 1 and 2). Actions taken by the Board during their 1987 spring meeting reestablished the resident tag fee and reduced the spring season in Subunit 22C.

An Emergency Order shortening the spring grizzly bear season in Subunit 22C was issued during the reporting period. The 15 April season opening date was moved to 10 May, because intensive hunting pressure by Nome residents in past years has led to concern of possible overharvesting.

During their 1987 spring meeting, the Board of Game took action on 5 proposals pertaining to grizzly bears within Unit 22. A description of each proposal and actions taken are listed in Appendix A.

CONCLUSIONS AND RECOMMENDATIONS

Interest in Seward Peninsula grizzly bears has increased during the past 4 years. Reindeer herders and campers have complained of "too many bears". Registered guides continually press the Board and the Department to liberalize or eliminate the nonresident permit requirement. Others believe that bears are a major cause of moose calf mortality. A grizzly bear research program addressing productivity, population density, and interactions with ungulate populations is needed, if the Department is to adequately address these concerns.

A high level of compliance with sealing continues in the communities of Nome and Unalakleet. However, compliance with sealing requirements in other communities in the unit remains very poor. Most bears killed by rural residents in DLP are not reported; many individuals consider bears nuisances and do not believe it worth their effort to report the incident, especially if they are required by law to surrender the hide and skull to the Department. To improve overall compliance with DLP regulations, consideration should be given to changing them.

Conventional wildlife management principles are not widely accepted by many residents of Unit 22. Not all hunters residing in the unit purchase hunting licenses or hunt entirely within established season dates. Until these problems are resolved, full compliance with bear sealing regulations is unlikely. Until more is known about the Seward Peninsula grizzly bear population and increased compliance with current regulations is achieved, regulatory changes that would increase the harvest of grizzly bears in Unit 22 should be rejected.

PREPARED BY:

Robert Nelson
Game Biologist III

SUBMITTED BY:

Steven Machida
Survey-Inventory Coordinator

Table 1. Resident and nonresident grizzly bear harvests for spring (S) and fall (F)[a] in Unit 22, 1976-87.

Year	Resident harvest			Nonresident harvest			Total harvest			Percent 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	2	3	5	7	5	12	42
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	15	4	19	25	6	31	61
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	11	11	22	29	25	54	41
1985	20	13	33	8	12	20	28	25	53	38
1986	21	8	29	14	8	22	35	16	51	43
1987	9	13	22	13	7	20	22	20	42	48

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

Table 2. Annual harvest of grizzly bears[a] in Subunits 22A-E, 1979-87.

Year	22A	(%)	22B	(%)	22C	(%)	22D	(%)	22E	(%)	Unit totals
1979	10	20	28	56	8	16	3	6	1	2	50
1980	9	29	10	32	8	26	3	10	1	3	31
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	19	35	14	26	15	28	4	7	2	4	54
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
Mean 1979-87	12	32	14	36	8	20	4	10	1	2	39

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

Table 3. Number of permits available and number issued for grizzly bear drawing-permit hunts in Unit 22 1980-87.

Year	Spring			Fall		
	Available permits	Permits issued by drawing	Permits issued first-come first-served	Available permits	Permits issued by drawing	Permits issued first-come first-served
1980	0	0	0	14	11	0
1981	6	5	0	14	11	0
1982	6	5	0	14	4	0
1983	6	4	0	10	3	0
1984	10	6	1	10	10	0
1985	10	8	2	10	10	0
1986	10	10	0	10	10	0
1987	10	9	1	10	10	0

Table 4. Historical chronology of the grizzly bear harvest[a] in Unit 22, 1975-1987.

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

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

Appendix A: Proposals considered by the Board of Game during their spring 1987 meeting and the Board's actions.

1. Change the bag limit for grizzly bears from 1 bear every 4 years to 1 bear every 2 years. Rejected.

2. Reduce the spring season in Subunit 22C from 15 April- 25 May to 10 to 25 May. Approved.

3. Increase the number of grizzly bear permits available to nonresidents for Subunits 22B, 22C, 22D, and 22E from 10 in the spring and 10 in the fall to 20 in the spring and 20 in the fall. Rejected.

4. Change the nonresident bear permit system in Subunits 22B, 22C, 22D, and 22E to a general open season with a bag limit of 1 bear every four years. Rejected.

5. Reestablish the resident bear tag fee. The Board, at the request of the Attorney Generals Office, reinstated the $25 tag fee. Legislative intent was to allow the Board to remove the tag fee if sufficient evidence showed that removal would increase harvest of bears and reduce predation on ungulate populations. It was not the Legislature's intent to have the tag fee requirement removed for any other reason.

STUDY AREA

GAME MANAGEMENT UNIT: 23 (43,000 mi²)

GEOGRAPHICAL DESCRIPTION: Kotzebue Sound and western Brooks Range

BACKGROUND

Relatively little is known of the status and harvest of grizzly bears in Unit 23 prior to 1970. Bears have been harvested opportunistically for subsistence use by Eskimos residing in northwestern Alaska since aboriginal times. Historically, Eskimo hunting practices included harvesting bears with primitive weapons in dens prior to spring emergence; however, with the advent of more sophisticated weapons, this technique is rarely used.

Grizzly bears continue to be harvested at low levels each year by local residents for subsistence purposes. However, actual numbers are difficult to determine because compliance with sealing requirements remains poor. The reported harvest has increased during the past 2 decades.

POPULATION OBJECTIVES

To develop management goals for population levels upon receipt of adequate public input.

To minimize adverse interactions between grizzly bears and the public.

METHODS

During late May and early June 1987, a grizzly bear population census was conducted in a 719-mi² portion of the Noatak and Wulik River drainages. The census technique and results have been described by Ballard et al. (1988).

Harvest information for 1987 came from sealing certificates and hunter interviews conducted by Division of Subsistence staff in Kotzebue. Additional information concerning bear numbers and distribution came from sightings reported by the public and Department staff.

RESULTS AND DISCUSSION

Population Status and Trend

Results from the census conducted during the spring of 1987 indicated that the bear population in the most heavily hunted portion of Unit 23 is healthy. The estimated density of 1 bear/19 mi² is considered high for an arctic ecosystem (Ballard et al. 1988); however, the census area also contains some of the best

grizzly bear habitat in Unit 23. Although other parts of Unit 23 probably had fewer grizzly bears than the census area, the unit as a whole contains a healthy population.

Population Size:

During a survey in April 1983 Quimby (1984) estimated the grizzly bear density in Unit 23 at 2.5 bears/100 mi^2. Similar to results reported by Ballard et al. (1988), Reynolds (1982) determined that a high bear density in optimum habitat is 5 bears/100 mi^2; he further suggested that a low density in lower-quality habitat is 1.25 bears/100 mi^2. If we arbitrarily assume that the midpoint between these high and low density estimates is representative of the mean bear density in Unit 23, the unitwide bear density is estimated at 2 bears/100 mi^2. If we extrapolate this density estimate to the 43,000 mi^2 in Unit 23, we come up with a crude population estimate of 860 grizzly bears. If we use Quimby's estimate of 2.5 bears/100 mi^2, the Unit 23 population is estimated at 1,075 bears. Because the above extrapolations do not account for the different amounts of good- and poor-quality habitat found in Unit 23, the resulting population size estimates should be viewed as tentative.

Population Composition:

Ballard et al. (1988) captured and tagged 83 grizzly bears during 1986 and 1987 (Table 1), including 32 males older than 1 year, 41 females older than 1 year, 3 male cubs-of-the-year, and 7 female cubs-of-the-year. Average litter size at den emergence in 1986 and 1987 was 2.8 cubs (n = 6).

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.

Human-induced Mortality:

The reported grizzly bear harvest in Unit 23 for 1987 was 35 bears. The average annual reported grizzly bear harvest between 1970 and 1987 was 31 bears (Table 2). Boars composed approximately 70% of the annual harvest since 1970, and sows accounted for 28%. In 1987, 23 harvested bears were boars, 10 were sows, and the sex was not specified for 2 bears. As in past years, most of the harvest was reported from the Noatak River drainage (Table 3).

The mean age of the 1987 reported harvest was 8.9 years (n = 32), nearly a year older than the 1969-1987 mean of 8.0 years (n = 505,

Table 4). Mean age of male bears killed in 1987 was 9.2 years ($\underline{n}$ = 23), compared with a mean of 8.2 for male bears killed between 1969 and 1987 ($\underline{n}$ = 360). The mean age of females killed in 1987 was 8.2 years ($\underline{n}$ = 9), compared with a mean of 7.3 years for females killed between 1969 and 1987 ($\underline{n}$ = 145). Mean skull size of the 1987 reported harvest was 22.38 inches (SD = 2.43, $\underline{n}$ = 17) for males and 20.09 inches (SD = 1.13, $\underline{n}$ = 9) for females.

For the 3rd consecutive year, annual changes in the harvest in Unit 23 were measured against hunting effort (Table 5). By ranking the years 1969 and 1987 from highest to lowest in terms of total harvest and from lowest to highest in terms of hunting effort (i.e., number of hunting days), an overall score for each year was derived by adding the 2 rankings together. With an overall score of 9, 1983 was the best year in terms of numbers of bears harvested, relative to hunting effort exerted; lowest in the rankings was 1971. The 1987 ranking score of 15 placed the 1987 harvest, relative to hunting effort, at position number 4. No apparent patterns are discernable that would suggest changes in the number of harvestable bears or in hunting effort.

The unreported harvest of grizzly bears remains a problem in Unit 23. Recently, Division of Subsistence staff initiated a research project aimed at providing more complete harvest information. By comparing information obtained through hunter interviews with information available from sealing certificates, Loon and Georgette (1989) estimated that as few as 12-16% of the bears harvested by residents of Unit 23 are actually reported. The reported annual harvest of zero to 5 bears by residents in Unit 23 could be as high as 40-50 bears. When combined with the harvest attributable to other Alaska residents and nonresidents, the total harvest may approach 70-80 bears/year.

Of 30 adult (i.e., 4 years or older) females captured and radio-collared during 1986 and 1987, one (3%) was reported harvested. Of the 24 males captured and collared, four (17%) were reported harvested, two (8%) were missing because of radio-collar failures or unreported harvest, and one (4%) apparently died of natural causes (Ballard et al. 1988).

Hunter Residency and Success. Nonresident and resident hunters accounted for 43% and 51% of the 1987 reported harvest, respectively; residency status could not be determined for 6% of those harvesting bears.

Permit Hunts. Although both resident and nonresident hunters are allowed to take 1 grizzly bear every 4 regulatory years, nonresidents may only hunt in Unit 23 if they are successful in drawing one of 25 permits. Up to 7 nonresident permits are issued in the spring and 18 in the fall. In 1987 all 25 permits were issued.

Harvest Chronology. Of the 35 bears reported harvested during 1987, 15 were killed in the spring and 20 in the fall. Nine of the 15 bears killed in the spring were harvested during the 1st 2 weeks of the season, and half of the 20 bears killed during the fall were taken during the 1st 2 weeks of the season. One bear was reported killed in defense of life or property 1 week after the close of the spring season.

Transport Methods. Twenty-two bears harvested in Unit 23 during 1987 were taken by hunters using aircraft for transportation. Two hunters reported using off-road vehicles, three used boats and eight did not specify transportation means. Some hunters use snow machines to access hunting areas in the spring.

Natural Mortality:

An unknown number of grizzly bears die from wounds suffered in intraspecific disputes as well as from sickness and accidents. Our findings suggest that initial cub-of-the-year mortality is high during the spring; of 13 adult females judged to be reproductively mature in 1986, six were lactating but were not accompanied by young when captured. Infanticide caused by other bears is probably responsible for at least a portion of the cub mortality. Survival of cubs during their 1st summer averaged 79%, and survival of yearlings averaged 86% (Ballard et al. 1988).

Habitat Assessment

Habitats in much of Unit 23 appear well suited to grizzly bears. Caribou and moose are abundant throughout the unit, and in many drainages, salmon are seasonally abundant as well.

The recent development of the Red Dog mine site in the western DeLong Mountains and a road connecting a seaport with the mine site have caused and will continue to cause habitat alterations. Impacts from mining development on grizzly bears are being monitored as part of ongoing research in the vicinity of the mine, road, and port sites, including an assessment of the interactions between mine employees and bears. An information and education program conducted in cooperation with mine site managers is being planned by Department staff. Techniques for minimizing adverse interactions between bears and workers will be discussed with mine employees.

Game Board Actions and Emergency Orders

The length of the grizzly bear season in Unit 23 has varied over time. From 1961 to 1968, the annual season lasted 154 days, excluding 1963 when the season lasted 166 days. Between 1969 and 1976, the annual season length varied from a high of 123 days to a low of 31 days. Beginning in 1982 the annual season length has remained constant at 81 days.

CONCLUSIONS AND RECOMMENDATIONS

The grizzly bear population in Unit 23 appears to be healthy at the present time. An ongoing research study that is providing population information useful for management will also help assess the impacts of mine development on grizzly bears in the Arctic regions of Alaska.

Some local residents have expressed concerns about losses of property and threats to humans from what is perceived as a high number of bears in the unit. In the past we were unable to quantitatively define the amount constituting a "high" number of bears; however, the density of grizzly bears in at least a portion of Unit 23 is considered high by the scientific community. Consequently, liberalizing the grizzly bear seasons in Unit 23 may be a possibility; however, pending final analyses of the available data and more formal input from the public, no regulation changes are recommended at this time.

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PREPARED BY:

Douglas N. Larsen
Game Biologist III

SUBMITTED BY:

Steven Machida
Survey-Inventory Coordinator

Table 1. Sex and age composition of grizzly bears captured in the southwest Brooks Range of Unit 23, 1986 and 1987 (from Ballard et al. 1988).

Bear ID	Date of capture	Sex	Weight (lbs)	Cementum age	Physical condition[a]
001[b]	05/31/86	F	235	5.5	3
002[b]	05/31/86	F	210	5.5	2
003[b]	05/31/86	M	412	7.5	2
004[b]	06/01/86	F	225	6.5	3
005	06/01/86	F	022	0.5	--
006	06/01/86	F	028	0.5	3
007[b]	06/02/86	M	390	8.5	1
008[b]	06/02/86	F	210	4.5	1
009	06/02/86	F	248	13.5	3
009[b]	05/31/87	F	284	14.5	2
010[b]	06/02/86	M	--	11.5	--
010	05/29/87	M	--	12.5	--
011	06/03/86	F	013	0.5	1
012[b]	06/02/86	M	475	12.5	1
012	06/08/86	M	--	12.5	--
013	06/03/86	F	235	7.5	4
014[b]	06/03/86	F	210	9.5	4
015	06/03/86	M	014	0.5	2
016	06/03/86	M	016	0.5	2
017	06/03/86	M	080	2.5	3
018[b]	06/03/86	F	320	8.5	4
019[b]	06/04/86	M	--	11.5	3
020[b]	06/04/86	F	140	5.5	4
021[b]	06/03/86	F	250	12.5	2
022[b]	06/04/86	F	215	8.5	4
023	06/04/86	M	078	1.4	4
024[b]	06/04/86	M	435	8.5	2
025[b]	06/04/86	F	225	12.5	3

Table 1. Continued

Bear ID	Date of capture	Sex	Weight (lbs)	Cementum age	Physical condition[a]
026[b]	06/04/86	F	--	3.5	3
027[b]	06/05/86	M	335	8.5	3
028	06/05/86	F	260	9.5	3
028[b]	05/28/87	F	254	10.5	3
029[b]	06/05/86	M	425	7.5	2
030[b]	06/05/86	M	485	11.5	2
031	06/05/86	M	190	3.5	3
031[b]	06/04/87	M	225	4.5	4
032	06/05/86	F	138	3.5	4
032[b]	06/01/87	F	199	14.5	3
033	06/06/86	F	155	7.5	4
034[b]	06/07/86	M	310	5.5	4
035	06/07/86	M	215	5.5	3
035[b]	06/03/87	M	294	6.5	4
036	06/07/86	F	--	--	4
037	06/07/86	M	--	2.5	3
038	06/07/86	F	185	3.5	2
039[b]	06/07/86	F	275	8.5	4
040[b]	06/07/86	M	435	7.5	2
041[b]	06/08/86	F	186	6.5	4
042[b]	06/08/86	M	230	4.5	3
042	06/02/87	M	259	5.5	3
043[b]	06/09/86	F	276	17.5	2
044[b]	06/08/86	M	435	7.5	2
045[b]	06/09/86	M	390	8.5	3
046[b]	06/09/86	M	405	8.5	4
047	06/05/86	F	--	--	5
048	05/28/87	M	022	0.5	4
049	05/28/87	F	018	0.5	-

Table 1. Continued.

Bear ID	Date of capture	Sex	Weight (lbs)	Cementum age	Physical condition[a]
050[b]	05/28/87	M	299	--	1
051[b]	05/28/87	F	225	--	3
052[b]	05/29/87	F	---	--	4
053[b]	05/29/87	F	225	--	2
054	05/29/87	F	---	--	5
055[b]	05/29/87	F	199	--	5
056[b]	05/29/87	M	399	--	2
057[b]	05/30/87	M	324	--	4
058[b]	05/30/87	F	259	--	4
058	06/01/87	F	259	--	1
059[b]	05/30/87	F	210	--	5
060	05/30/87	F	006	0.5	--
061	05/30/87	F	008	0.5	--
062	05/30/87	F	008	0.5	--
063[b]	05/30/87	F	229	--	--
064[b]	05/30/87	M	489	--	4
065[b]	05/31/87	F	249	--	4
066[b]	05/31/87	F	130	--	4
067[b]	05/31/87	F	229	--	4
068[b]	05/31/87	M	500	--	4
069[b]	06/02/87	F	244	--	4
070[b]	06/02/87	F	200	--	4
071[b]	06/02/87	F	180	--	4
072[b]	06/02/87	M	394	--	3
073[b]	06/04/87	M	277	--	4
074[b]	06/04/87	F	259	--	3

[a] Condition: 1 = good, to 5 = bad.
[b] Radio-collared.

Table 2. Reported grizzly bear harvest from Unit 23, 1970-1987.

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
Total	388 (70%)	154 (28%)	15 (2%)	557

Table 3. Locations of reported grizzly bear harvest within Unit 23, 1970-1987.

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
Total	290 (52%)	78 (14%)	67 (12%)	16 (3%)	55 (10%)	41 (7%)	10 (2%)	557

Table 4. Mean ages[a] of male and female grizzly bears reported harvested from Unit 23, 1969-1987[b].

Year	Males		Females		Total	
	n	Mean age	n	Mean age	n	Mean age
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
1972	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
Total	362	8.3	145	7.1	507	7.9

[a] Years

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

Table 5. Reported numbers of bears harvested and successful hunter effort exerted each year as well as rankings of bear numbers and hunter success each year relative to other years in Unit 23, 1969-1987.

Year	Hunter days	Total bears killed[a]	Hunter days/ bear[b]	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	11
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	48 (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
Total	1,993	571			

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

[b] Numbers in parentheses represent rank numbers for hunter effort for each year relative to all years; 1 = lowest; 16 = highest.

STUDY AREA

GAME MANAGEMENT UNIT: 24 (27,940 mi^2); 25A, 25B, and 25D (41,400 mi^2); 26A, 26B, and 26C (78,959 mi^2)

GEOGRAPHICAL DESCRIPTION: Brooks Range. Unit 24, upper Koyukuk River drainage and south-central Brooks Range; Unit 25, southeastern Brooks Range and upper Yukon River drainage except White Mountains and northern Tanana Hills; and Unit 26, north slope of the Brooks Range and arctic coastal plain

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 Units 24, 25, and 26. Adjusting season lengths and opening dates in the Brooks Range did not solve the problem. Illegal harvest and false reporting of grizzly bear harvest locations were common during this period, and eventually Subunits 26B and 26C were closed to grizzly bear hunting in 1971-72. Since then a variety of regulations, primarily lottery permit hunts, have resulted in low harvests and increased abundance of grizzly bears.

In the early 1970's, a continuous series of grizzly bears studies in the Brooks Range began. Research in the central and eastern Brooks Range from 1971 through 1975 demonstrated that population density, productivity, and recruitment were lower than for brown/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 24, 25, and 26 as well as in the Noatak River drainage (i.e. Unit 23) above the Nimiuktuk River. Beginning in 1977, harvest was limited by restricted 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 grizzly bear populations to provide sustained opportunity to hunt grizzly bears under aesthetically pleasing conditions.

MANAGEMENT OBJECTIVES

To sustain a mean annual harvest of 20 bears, including a minimum of 60% males, in the harvest in Unit 24.

To sustain a mean annual harvest of 20 bears, including a minimum of 60% males, in the harvest in Unit 25.

To sustain a mean annual harvest of 12 bears, including a minimum of 60% males, in Subunits 26 and 26C.

METHODS

Grizzly bear population size and density were estimated during research studies conducted in Subunits 26A (1977-87), 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 systems in 1977, grizzly bear populations began to recover or increase in Subunits 25A, 26A, and 26C (Garner et al. 1984, Reynolds and Hechtel 1984). These conclusions are supported by observations from other biologists and guides. Grizzly bear populations in eastern Unit 24 and Subunit 26B are probably stable but may decline if the high level of harvest reported in 1987 continues. In these areas, grizzly bears are accessible to hunters from the Dalton Highway. Hunting pressure continues to be low in Subunits 25B and 25D, and populations are probably stable.

Population Size:

Estimations 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, an estimate of density 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 results in a population estimate of 2,990-3,620 bears for the entire area (Table 1).

Population Composition:

Recent population composition data are available only for the western Brooks Range near the headwaters of the Utukok and Kokolik Rivers (Reynolds and Hechtel 1984). In that area, approximately 40% of the grizzly bears greater than 1 year old are males and 60% are females. The sex ratio of cubs and yearlings is probably equal but may slightly favor females. Preliminary analysis of data from research conducted in Subunit 26C indicates an even sex ratio for grizzly bears older than yearling age class (Garner et al. 1984).

Percentages of bears by age classes for the western Brooks Range population were as follows: cubs, 13.0%; yearlings, 10.7%; 2-year-olds, 13.7%; 3- and 4-year-olds, 10.7%; and >5 years of age, 51.9% (Reynolds and Hechtel 1984). For comparison, in 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 >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 alpine and foothill portions of the area 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 they move from the mountains and foothills to the coastal plain when calving caribou are available. No similar pattern has been observed in the caribou calving grounds of the Western Arctic Caribou Herd (Reynolds and Garner 1987).

Mortality

Season and Bag Limit:

Spring 1987.

Unit 24, northern portion, excluding Gates of the Arctic National Park	10-31 May	One bear every four regulatory years by registration permit; 20 bears may be taken
Unit 24 and 26A, within Gates of the Arctic National Park	1 July-30 June	One bear by registration permit only
	1 Apr-31 May	(Residents of Anaktuvuk Pass only) one bear
Unit 24, remainder	10-31 May	One bear every four regulatory years
Unit 25B, 25D, 25A (Hodzana River drainage)	10-25 May	One bear every four regulatory years
Unit 25A, Sheenjek, Coleen, and Porcupine River	10-31 May	One bear every four regulatory years (Residents); one bear every four regulatory years by drawing permit (Non-residents) 6 permits to be issued

Unit 25A, E. Fork Chandalar and Christian River drainages	10-31 May	One bear every four regulatory years (Residents); one bear every four regulatory years by drawing permit (Non-residents) 6 permits to be issued
Unit 25A, Chandalar River drainage excluding the E. Fork Chandalar River	10-31 May	One bear every four regulatory years (Residents); one bear every four regulatory years by drawing permit (Non-residents) 6 permits to be issued
Unit 25C	1 Apr-31 May	One bear every four regulatory years
Unit 26A, east of 159 W. long.	10-31 May	One bear every four regulatory years (Residents); one bear every four regulatory years by drawing permit (Non-residents) 8 permits to be issued
Unit 26A, west of 159 W. long.	10-31 May	One bear every four regulatory years (Residents); one bear every four regulatory years by drawing permit (Nonresidents) 8 permits to be issued
Unit 26B	1-10 May	One bear every four regulatory years, by registration permit only.
Unit 26C	10-31 May	One bear every four regulatory years (Residents); one bear every four regulatory years by drawing permit (Nonresidents) 5 permits to be issued

Fall, 1987.

Unit 24, northern portion, excluding Gates of the Arctic National Park	1 Sept-Oct 31	One bear every four regulatory years by registration permit; 15 bears may be taken
Unit 24 within Gates of the Arctic Nat'l. Park and Unit 26A east of 159 W. long.	1 Sept-Oct 31	One bear every four regulatory years
Unit 24, remainder	1 Sept-31 Dec	One bear every four regulatory years
Unit 25B, 25D, 25A (Hodzana River drainage)	1 Sept-10 Oct	One bear every four regulatory years
Unit 25A, Sheenjek, Coleen, and Porcupine River	1 Sept-31 Oct	One bear every four regulatory years (Residents); one bear every four regulatory years by drawing permit (Non-residents) 9 permits to be issued
Unit 25A, E. Fork Chandalar and Christian River drainages	1 Sept-31 Oct	One bear every four regulatory years (Residents); one bear every four regulatory years by drawing permit (Non-residents) 9 permits to be issued
Unit 25A, Chandalar River drainage excluding the E. Chandalar River	1 Sept-31 Oct	One bear every four regulatory years (Residents); one Fork bear every four regulatory years by drawing permit (Non-residents) 9 permits to be issued
Unit 25C	1 Sept-30 Nov	One bear every four regulatory years
Unit 26A, east of 159 W. long.	1 Sept-31 Oct	One bear every four regulatory years, (Residents); one bear every four regulatory

		years by drawing permit (Nonresidents) 8 permits to be issued
Unit 26A, west of 159 W. long.	1 Sept-31 Oct	One bear every four regulatory years, (Residents); one bear every four regulatory years by drawing permit (Nonresidents) 8 permits to be issued
Unit 26B	1-10 Oct	One bear every four regulatory years, by registration permit only
Unit 26C	1 Sept-31 Oct	One bear every four regulatory years (Residents); one bear every four regulatory years by drawing permit (Nonresidents) 5 permits to be issued

Human-induced Mortality:

During 1987, the reported harvest from Units 24 and 26 and Subunits 25A, 25B, and 25D was 93 bears, the highest on record (Table 2). This total includes 75 bears taken in areas requiring resident registration or nonresident lottery permits. In those portions of Units 24 and 25 where permits were not required, 18 were reported killed. However, there is evidence that all 10 of those reported for Unit 24 were actually killed in Unit 23 and the locations falsely reported.

The unusually large harvest taken during 1987 came primarily from western Subunits 26A, 26B, and 26C. In western Subunit 26A (west of 159 degrees longitude), much of the harvest was the result of guides "pioneering" areas not restricted by the exclusive guide area system. In Subunit 26B, the increase in harvest was probably due to a combination of changes in season timing, deletion of registration permit requirements, and increased interest by hunters in an area with road access. In Subunit 26C the additional harvest was probably due to increased interest by resident hunters for all species in the Marsh Fork and Canning River drainages.

During the last 10 years, the average harvest rates for Brooks Range grizzly bears have probably been within sustainable levels. However, if the pattern and level of harvest observed in 1987 continue, localized overharvesting may occur in the more readily accessible areas. Those portions of Unit 24 and Subunit 26B that lie along the Dalton Highway are of particular concern. Some

access points in Subunits 26A and 26C also supported 1987 harvests that are probably not sustainable. In Subunit 26B, where the recommended harvest was exceeded by a factor of two times, a drawing-permit system for all hunters may be required.

Not counting the 10 bears that were probably falsely reported as taken in Unit 24, 68.7% of 83 bears taken in the Brooks Range units were males. Five grizzly bears were killed in defense of life or property: two in the portion of Unit 24 for which permits are required, two in Subunit 25D, and one in Subunit 26B.

Hunter Residency and Success. Of successful hunters, residents accounted for 40% of the harvest for Units 24-26. By unit, residents accounted for six of 10 bears legally taken in Unit 24: four of 19 in Unit 25, and 21 of 49 taken in Unit 26. Bears killed in defense of life or property were not included in these totals.

Permit Hunts. During 1987, drawing permits were required for nonresident hunters in Subunits 25A, 26A, and 26C. Registration permits were required for all hunters in Unit 24. During the spring season in Subunit 26B, registration permits were required for all hunters; during the fall season, drawing permits were required for nonresidents, but not for residents. The harvest by hunters holding permits in Unit 24 was 9 bears: two in Subunit 25A (east), three in 25A (central), six in 25A (west), four in 26A (east), thirteen in 26A (west), eight in 26B, and four in 26C. The total harvest in areas requiring permits was 75 (Table 2); the harvest by nonresident permit holders was 49.

Natural Mortality:

Natural mortality rates have only been determined for 3 age classes of offspring under maternal care in a study area in the western Brooks Range. In that area, these rates were 47% for cubs, 12% for yearlings, and 13% for 2-year-olds (Reynolds and Hechtel 1984).

Habitat

Assessment:

Climate and length of the growing season, rather than habitat quality or availability, are probably most important in determining Brooks Range grizzly bear productivity. The 2 areas with the highest observed density and productivity are caribou calving grounds; availability of caribou calves rather than vegetational habitat probably has the greatest effect in those areas (Reynolds and Garner 1987).

Enhancement:

Habitat enhancement programs would probably have minimal effect on grizzly bear productivity in this area. None have been planned in the Brooks Range units.

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 23 (upper Noatak portion), 32 permits; Unit 24, 40; Unit 25 and Subunit 26C, 48 (10 of these for the Arctic National Wildlife Refuge); Subunit 26A, 24; and Subunit 26B, 16. Major changes to the permit system, by regulatory year, follows:

1. In 1978-79, boundary adjustments excluded portions of the units where bears were less vulnerable to hunting;

2. In 1980-81,Unit 23 was managed separately from Units 24-26; Subunit 26A was separated into 2 portions, each with 24 permits to distribute hunting pressure;

3. In 1982-83,registration permits, instead of drawing permits, were required for the portion of Unit 24 in Gates of the Arctic National Park; drawing permits were required for any 1984-85 hunters in Unit 24, Subunits 26A (east) and 26B, and,for nonresident hunters only in Subunits 25A, 26A (west), and 26C;

4. In 1985-86,registration permits were required in Subunit 26B with a season of 1-10 October and 1-10 May and registration permits were required in Unit 2

5. In 1986-87,drawing permits were required for nonresident hunters only in Subunit 26A (east); and,

6. In 1987-88, drawing permits were required for nonresident hunters only in Subunit 26B. Residents of Anaktuvuk Pass were allowed to take 1 bear per year in Unit 24 and Subunit 26A and they were no longer required to possess registration permits in Gates of the Arctic National Park.

CONCLUSIONS AND RECOMMENDATIONS

Although grizzly bear harvest in the Brooks Range units reached a record of 96 bears in 1987, this level of harvest probably did not exceed sustainable levels in Units 24 or 25. No changes in the present permit system are recommended at this time. In Subunits 26A and 26C, the harvests did not exceed sustainable levels on a unit-wide basis, but if present patterns continue, portions of the units may become overharvested. This localized problem could be solved by more even distribution of hunting pressure. In Subunit

26B, the long-term average harvest rate is sustainable; however, if the harvest exceeds 10 bears in 1988, a more restrictive permit system may be necessary to meet the management goal.

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PREPARED BY:

Harry V. Reynolds
Wildlife Biologist III

SUBMITTED BY:

Wayne E. Heimer
Survey-Inventory Coordinator

Table 1. Sustainable and reported 1987 grizzly bear harvests in the Brooks Range based on estimated population densities and an allowable harvest rate of 4%.

Area	Area (mi^2)	Est. density /100m^2	Est. pop. size	Harvest @ 4%	1987 mortality[a] Permit areas	Open
Unit 24						
Gates[b]	7,000	3.3	230	9	0	
Northern[c]	6,500	3.3	220	9	12	
Southern[c]	14,500	2.2-3.3	320-480	13-19		10
Unit 25						
Subunit 25A	19,500	2.2	430	17	13	
Subunit 25B & Subunit D	22,000	1.7-2.2	380-480	15-19		8
Subunit 26A						
West portion:						
northern	9,000	1.0	90	4		
southern	6,200	5.0	310	12		
Subtotal	15,200		400	16	15	
East portion:						
northern	20,900	0.3	60	2		
southern	17,700	2.2-3.3	390-590	16-24		
Gatesb	2,400	2.2-3.3	50-70	2-3		
Subtotal	41,000		500-720	20-29	11	
Subunit 26B						
northern	7,500	1.0	80	3		
southern	6,100	2.2	130	5		
Subtotal	13,600		210	8	15	
Subunit 26C	9,100	3.3-5.0	300-450	12-18	9	
Total	148,400		2,990-3,620	119-145	75	18

[a] Includes all human-caused mortality. In permit areas, permits may be required for nonresidents, but not for residents. In open areas of Units 24 and 25, no permits are required.

[b] At present, only residents of Anaktuvuk Pass are allowed to hunt within the boundaries of Gates of the Arctic National Park.

[c] In Unit 24, northern and southern portions correspond to areas where permits are or are not required, respectively; in Subunits 26A and 26B, northern and southern portions correspond to areas of different estimated grizzly bear densities.

Table 2. Human-induced mortality of grizzly bears in Game Management Units 24-26, 1977-1987.

Unit	Estimated population	Human - caused mortality[a] 1977-1981	1982	1983	1984	1985	1986	1987
Permit areas								
24	220	8.0	1	7	5	3[b,c]	7	12
24 Gates[b]	230	5.2	0	2	1	0	1	0
25A	430	8.2	15	16	12	13	12	13
26A west	400	3.8	2	4	9	2	9	15
26A east	500-720	5.4	11	11	5	8	11	11
26A Gates[b]	50-70	0	2	1	1	2	1	1
26B	210	5.2	4	9	7	4	5	15
26C	300-450	2.0	4	2	3	6	8	9
Subtotal	2,290-2,690	32.6	37	49	41	36	48	75
Nonpermit areas								
24c	320-480	4.6	3	6	2	3	3	10
25	380-480	5.4	3	4	1	1	2	8
Subtotal	700-960	10.0	6	10	3	4	5	18
Total	2,990-3,620	42.6	43	59	44	40	53	93

[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.

[b] Gates of the Arctic National Park and Preserve includes portions of Unit 24 and Subunit 26A; the permit system there has differed from that in other portions of the units. (See section on Game Board actions.)

[c] Includes 10 which were suspected to be illegally killed in Unit 23 and reported as taken in Unit 24.

STUDY AREA

GAME MANAGEMENT UNIT: 26A

GEOGRAPHICAL DESCRIPTION: Western North Slope

BACKGROUND

Although densities of brown/grizzly bears vary widely throughout Subunit 26A, populations are thought to be stable. Densities are highest in the foothills of the Brooks Range and lowest in the northern portion of the subunit. Interest in harvesting bears remains high, and hunting pressure may be increasing in the western portion of the subunit. The unreported harvest remains a significant problem affecting the management of bears.

POPULATION OBJECTIVES

To maintain the grizzly bear population at present levels.

To minimize adverse interactions between grizzly bears and the public.

METHODS

Surveys for assessing the population size and status of grizzly bears were not conducted in Subunit 26A. A radiotelemetry study on bears in the southern portion of Subunit 26A has been underway for a number of years, and results have been reported in research progress reports. Harvest information received through the statewide sealing program was analyzed to determine location and sex and age composition of bears harvested during the year.

RESULTS AND DISCUSSION

Population Status and Trend

Reynolds (1984) indicated that the Brooks Range and North Slope grizzly bear densities varied from 0.3 to 5.9 bears/100 mi^2, depending on habitat type and topography. The mean density was estimated at 1 bear/100 mi^2. Based upon these densities, the population in Subunit 26A was estimated at 645-780 bears.

Permit-hunting requirements initiated during the 1977-78 regulatory year appear to have favorably affected Brooks Range grizzly bear populations, including those in Subunit 26A. We believe that populations in Subunit 26A are stable and may be at relatively high levels with respect to carrying capacity of the habitat.

Population Composition:

The most recent population composition and productivity data (Reynolds 1984) are available only for the western Brooks Range

near the headwaters of the Utukok and Kokolik Rivers. In that area, approximately 40% of the bears older than 1 year were males; 60% were females. The sex ratio of cubs and yearlings was approximately 50:50, but it may slightly favor females. Age composition was as follows: cubs, 13.0%; yearlings, 10.7%; 2-year-olds, 13.7%; 3- and 4-year-olds, 10.7%; and bears over 5 years of age, 51.9%. Mean age at 1st reproduction was 8.0 years, mean litter size was 2.0 cubs, mean reproductive interval was 4.0 years, and mean productivity was 0.5 cubs/year.

Mortality

Season and Bag Limit:

The subsistence hunting seasons in Unit 26A East (i.e., east of 159 degrees west longitude) for residents of Anaktuvuk Pass only are from 1 September to 31 October and from 1 April to 30 May. The bag limits for these 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 harvest of 1 bear every 4 regulatory years by drawing permit only is allowed; 8 drawing permits are issued.

The hunting seasons in Unit 26A West (i.e., west of 159 degrees west longitude) for subsistence, resident, and nonresident hunters are from 1 September to 31 October and from 10 May to 31 May. Subsistence and resident hunters are allowed to harvest 1 bear every 4 regulatory years. Nonresident hunters are allowed to harvest 1 bear every 4 regulatory years by drawing permit only; 22 permits are issued.

Human-induced Mortality:

Twenty-six bears were sealed in 1987; 15 of these were reported from Subunit 26A West, and the remainder were from 26A East. We believe that the actual number killed by hunters was higher (range, 36-40 bears). This estimate includes unreported mortalities from guided nonresidents, nonlocal Alaska residents, and residents of Subunit 26A. We believe that most of the unreported harvest was taken by residents of the subunit. Causes for not reporting harvests have been discussed previously (Trent 1985).

These data suggest that the 1987 harvest in Subunit 26A represented a marked increase from that in 1986; it was the 2nd consecutive year such an increase occurred. The reported harvest increased from 18 to 26 bears (44%), respectively (Table 1). The greatest increase occurred in Subunit 26A West; i.e. 5 bears in 1986 to 15 bears in 1987. In 1986, the estimated harvest for Subunit 26A, including the unreported kill, was 33-38 bears; in 1985 it was 22-26 bears.

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 from 1977 to 1981.

Game Board Actions and Emergency Orders

Until 1986 the season dates and bag limits for subsistence hunters and residents were identical. In the spring of 1986 the Board of Game agreed to give residents of Anaktuvuk Pass additional opportunity to harvest bears under the subsistence hunting regulations. They may now hunt bears 1 month earlier in the spring than other hunters, and their bag limit was changed from 1 bear every 4 years to 1 bear annually.

CONCLUSIONS AND RECOMMENDATIONS

Grizzly bear harvest increased from 1986 to 1987, particularly in Subunit 26A West. If we assume that safe harvest limits should not exceed 4% of the population and the size of the Subunit 26A is 645-780 bears, the allowable sustained yield is approximately 26-31 bears. The 1987 estimated harvest of 36-40 bears slightly exceeds this level. Because the harvest and population size estimates are fairly crude, I believe it is premature to suggest that overharvesting may be occurring. If the harvest continues to increase, additional regulatory restrictions may become necessary.

A significant management problem in Subunit 26A is that most local residents do not regularly report the grizzly bears they kill (Trent 1985). This management problem is due to at least 2 causes. Many local residents are either unaware or unsupportive of grizzly bear hunting regulations. Also, these regulations are not always compatible with the way local people hunt bears, which is to take them opportunistically as local conditions allow. Most hunters consider seasons, bag limits, and tag requirements to be unwieldy and cumbersome. In order to gain more local participation and effectively gauge the level of harvest, the grizzly bear regulations need to be extensively modified. These modifications should be implemented under a subsistence grizzly bear season for the entire North Slope (Unit 26). Until the point is reached where most of the bears killed are actually reported, the Department must continue to make allowance for a "shadow harvest" of unreported bears that may easily be 50-100% in excess of the number of bears actually sealed.

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PREPARED BY:

John N. Trent
Game Biologist III

Steven Machida
Game Biologist III

SUBMITTED BY:

Steven Machida
Survey-Inventory Coordinator

Table 1. Reported harvest of grizzly bears in Subunit 26A, 1983-87.

Unit	Estimated population	Harvest of 4%	Reported harvest[a]					
			1983	1984	1985	1986	1987	Mean
26A W	315-350	13-14	4[b]	10	3	5	15	7.4
26A E	330-430	13-17	11	12[c]	7	13	11	10.8
Totals	645-780	26-31	15	22	10	18	26	18.2

[a] Additional illegal harvest very likely took place within permit areas and was reported as outside permit areas.

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

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

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